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NASA-18440

**FINAL SUMMARY REPORT
OF THE
NASA SPACE LIFE SCIENCES
RESEARCH AND EDUCATION
SUPPORT PROGRAM**

11-51
2076

December 1, 1990 - September 30, 1995

**UNIVERSITIES SPACE RESEARCH ASSOCIATION
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William and Mary, College of
Wisconsin, University of, Madison
University

TO: Mr. Wayne C. Buckley, NASA Contracting Officer

FROM: Terri K. Jones, Project Manager, USRA/DSLS

DATE: 29 December 1995

RE: Contract Data Requirement; as per section J-1 of NASA contract #NAS9-18440

Mr. Buckley, attached is the final summary report, DRD No. MA-262T, of the above stated contract. The outline was submitted to the Contracting Officer's Technical Representative, Dr. Sawin, for approval August 24, 1995. Approval was received August 28, 1995 and a copy forwarded to your office where upon Ms. Tracy Hancock signed receipt and approval on August 30, 1995. A due date of December 30, 1995 was approved for this final report.

attachment: Final Summary Report on NAS9-18440

**cc: C. Sawin, NASA/COTR (6 copies)
W. Buckley, NASA/CO (1 copy)
NASA Scientific and Technical Information Facility (1 copy)
B. Ung, USRA/HQ Contracts (1 copy)
A. Coats, DSLS Director
J. Sevier, DSLS Deputy Director**

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FOREWORD

The Final Report of the NASA Space Life Sciences Research and Education Support Program reflects the tasks and manner of compliance of the Universities Space Research Association (USRA) Division of Space Life Sciences under Contract NAS9-18440. This report encompasses the entire contracting period from December 1, 1990 through September 30, 1995.

The Director of USRA's Division of Space Life Sciences is Alfred C. Coats, M.D. Deputy Director is Mr. John R. Sevier. Ms. Terri Jones is Project Manager.

INTRODUCTION

History

USRA's Division of Space Life Sciences (DSLS) was established in 1983 as the Division of Space Biomedicine to facilitate participation of the university community in biomedical research programs at the NASA Johnson Space Center (JSC). The DSLS is currently housed in the Center for Advanced Space Studies (CASS), sharing quarters with the Division of Educational Programs and the Lunar and Planetary Institute. The DSLS provides visiting scientists for the Johnson Space Center; organizes conferences, workshops, meetings, and seminars; and, through subcontracts with outside institutions, supports NASA-related research at more than 25 such entities.

The DSLS has considerable experience providing visiting scientists, experts, and consultants to work in concert with NASA Life Sciences researchers to define research missions and goals and to perform a wide variety of research administration and program management tasks. Since the inception of the DSLS, some 70 scientists have received research support through the DSLS, either while in residence in Houston or for projects carried out at their home institutions. More than 500 scientists from approximately 100 universities and other nongovernmental institutions have participated directly in related activities such as topical workshops, advisory groups, seminars, and educational activities.

Objectives of the Contract

The basic objectives of this contract have been to stimulate, encourage, and assist research and education in the NASA life sciences. Scientists and experts from a number of academic and research institutions in this country and abroad have been recruited to support NASA's need to find a solution to human physiological problems associated with living and working in space and on extraterrestrial bodies in the solar system.

Implementation of the Contract

To fulfill the contract objectives, a cadre of staff and visiting scientists, consultants, experts, and subcontractors was assembled into a unique organization dedicated to the space life sciences. This organization, USRA's Division of Space Life Sciences, has provided an academic atmosphere and an organizational focal point for science and educational activities, while serving as a forum for the participation of eminent scientists in the biomedical programs of NASA.

Purpose of This Report

The purpose of this report is to demonstrate adherence to the requirement of Contract NAS9-18440 for a written review and analysis of the productivity and success of the program.

RELATIONSHIP TO OTHER NASA EFFORTS

Overview of USRA

The Universities Space Research Association is a private, nonprofit corporation that was organized in 1969 by the National Academy of Sciences at the request of NASA. Upon incorporation, the Association was vested in a consortium of 49 universities. It was founded to provide a mechanism through which universities can cooperate effectively with one another, with the Government, and with other organizations to further space science and technology, and to promote education in these areas. Its mission is carried out through 13 institutes, centers, divisions (such as the Division of Space Life Sciences), and programs located across the nation. Ownership of USRA was vested in a university membership, now totalling 81 institutions, that oversees all activities, thus ensuring to the government that activities undertaken serve to benefit the broad community. Membership in USRA is not a requirement for participation in USRA programs. During 1993, 1,417 individuals from 314 universities and 162 individuals representing industry participated in USRA-sponsored programs and activities. Most of USRA's activities are funded by grants and contracts from the NASA.

USRA Management Structure

Management of the corporation is provided through USRA Headquarters, located in Columbia, Maryland. A staff of 23 in the Headquarters operation is headed by three corporate officers (President, Secretary, and Treasurer), a Chief Financial Officer, and a Procurement Officer. The headquarters staff is responsible for the day-to-day management of USRA's affairs in accordance with the policies and procedures approved by the Board. USRA Headquarters functions include all those normally associated with corporate operations and management.

In addition to the Columbia, Maryland office, USRA Headquarters staff manage the Association's office in Washington, D.C., less than one block from the NASA Headquarters building. The USRA board room and the USRA president's office are located in the Washington suite, which also provides office space for several USRA programs. An additional corporate responsibility is the publication of the *USRA Quarterly*, a newsletter distributed to approximately 12,000 individuals.

Established Networks with the Scientific Community

For more than two decades, USRA has fostered harmonious and productive collaborations among USRA, the federal government, and the scientific community. USRA's success in responding to the scientific requirements of the Government is largely

due to its capability to attract top quality scientists both from within the United States and abroad.

The DSLS has many resources from which to draw upon to identify scientific talent in specific discipline areas. In addition to the network established through USRA's eighty-one member universities and science councils, the DSLS has established a Space Life Sciences Consortium which consists of 41 academic institutions (37 in the United States). These academic institutions have agreed to join the Consortium for the purpose of collaborating in space life sciences research. Universities that are members of this Consortium are listed in Appendix VIII. The DSLS maintains communications with the Consortium through informal discussions, participation in meetings and seminars, and a newsletter.

Foreign Visitors Exchange Program

Due to its nonprofit status, USRA has an established foreign exchange program with the United States Information Agency. This foreign exchange program allows the DSLS to bring to NASA foreign visitors under the J-1 visa program with the Immigration and Naturalization Service. The DSLS prepares the necessary forms for obtaining J-1 visas and coordinates with NASA Security to obtain the necessary security clearances and badging for foreign visitors.

Interface with Universities and Government Agencies

Each of the 81 USRA member universities appoints a representative to serve on USRA's Council of Institutions, which meets annually to review the progress of the Association, provide policy guidance to the Board of Trustees, and elect members to the Board. In turn, the Board of Trustees sets corporate policy. One board member is selected from each of nine geographical regions, a procedure that assures broad geographical representation. Each regional trustee is a faculty member or administrative officer at a member university. In addition, there are three at-large members, nominated by the Council. The Board appoints the officers of the Association and sets corporate policy, while matters relating to science and technical management are normally delegated to the appropriate Science Council.

Each institute or program is overseen by a Science Council. The Science Council structure is a unique feature of USRA management, upon which the Association relies to accomplish many of its objectives (e.g., peer oversight of programs, recruitment of directors, and technical guidance.) This management approach would be virtually impossible were it not for USRA's status as a nonprofit national consortium of major universities. Each Science Council provides coverage for the discipline areas of its

assigned programs or institutes, and program representatives are encouraged to participate in the Council's reviews.

From time to time, scientists from other government agencies are called upon to serve on DSLS working groups, peer review panels, and committees. Their presence is facilitated through interagency agreements and reciprocal travel arrangements.

RESEARCH INITIATIVES

The DSLS has developed a multipronged strategy to achieve its primary objectives of stimulating, encouraging, and assisting research and education in the NASA life sciences. Visiting and staff scientists - experts in a wide variety of discipline areas - are enlisted to spend from one to approximately three years at a NASA facility on projects of mutual interest to the scientists and the sponsoring laboratories. Specific research requirements, such as hardware design and software development, are filled by consultants, who are also recognized experts in their fields. Communication between NASA scientists and the academic community as a whole is facilitated by DSLS-sponsored seminars, conferences, and workshops. Outside academic input into space life sciences is also facilitated by DSLS-administered *ad hoc* investigative and policy-making committees. Finally, some NASA research needs are best filled by scientists working in their home institutions. In those instances, the DSLS has secured subcontracts that support NASA-funded research carried out at nongovernmental academic institutions.

Discipline Areas

The environment created by space flight causes adverse physiological changes in a wide variety of systems. Understanding and devising methods of counteracting these changes thus requires a research program encompassing many different disciplines. To meet this need, the DSLS program is extremely broad-based, encompassing the following disciplines:

Artificial Gravity	Barophysiology
Biomedical Engineering	Biomedical Ethics
Biostatistics	Biotechnology
Bone and Muscle Physiology	Cell Culture
Computer Modeling of Physiological Systems	Environmental Health
Endocrinology and Metabolism	Exercise Physiology
Exobiology/CELSS	Hematology and Immunology
Human Factors	Life Sciences Administration
Life Sciences Education	Neuroscience
Pharmacology	Pulmonary Physiology
Radiation Sciences	Software Development
Vestibular Physiology	

Visiting and Staff Scientists

Visiting and staff scientists are invited for one to three years, usually to facilitate research collaboration between an outside academic institution and NASA. Typically, a Visiting Scientist either fills a specific NASA research need, or has specialized expertise

not available at NASA. Occasionally a visiting scientist will engage in a project of his/her own that complements NASA's ongoing research. Staff Scientists are longer term appointees who typically assist with ongoing administrative tasks in addition to carrying out long-term research projects. Those who have served as USRA DSLS Visiting and Staff Scientists are listed in Appendix I.

In 1994 the DSLS initiated a highly successful search for the JSC Human Research Facility (HRF) Visiting Scientist Program. Over 40 highly qualified scientists applied for the two positions offered by the program. Initial collaborations with the two scientists proved so worthwhile that the efforts were extended.

Another nationwide search in 1995 resulted in over 100 inquiries that netted 36 applications. From the six finalists, two winners, whose tenure holds great promise, were selected.

Consultants

From time to time, NASA life science needs require the assistance of scientific experts for short-term assignments such as fulfilling specific research project requirements or developing specific flight hardware items. Through consulting arrangements, the DSLS has provided such assistance. All DSLS consultants (listed in Appendix II) sign a consulting agreement before beginning their work for USRA. After completing the assigned task, the consultant submits an invoice voucher to the Project Manager for approval and processing.

The DSLS also has in place a mechanism for paying honoraria for such special expert services as the presentation of papers at conferences, symposia, workshops, meetings, or seminars; for services on *ad hoc* investigative, review, or policy-making committees; and for limited short-term scientific support. This system has offered NASA life sciences the talents of distinguished scientists on an occasional short-term or one-time basis. Appendix III lists scientists who have received DSLS honoraria over the last year.

Subcontracts

Some NASA research needs are best met by an arrangement that includes a scientist plus his/her home institution or laboratory. This arrangement, defined in a subcontract between the DSLS and the home institution, has afforded NASA the opportunity to utilize the scientist's expertise on a relatively short-term basis for a specific task or project, while the home institution received outside support for its employee and the prestige of collaboration with NASA. Likewise, the scientist benefited by retaining

his permanent position and tenure with his home institution while he/she was also able to forge a collaboration with NASA. USRA has found that such an arrangement enhances participation in the scientific community by universities. The DSLS has extensive experience initiating and managing subcontracts supporting NASA-funded research carried out at nongovernmental academic institutions. Appendix IV shows the diversity, both in discipline and geographic areas, of the subcontracts administered by the DSLS.

Research Facilities

The DSLS is housed in the Center for Advanced Space Studies (CASS), 3600 Bay Area Boulevard, Houston, Texas, 77058-1113. CASS is home to the Lunar and Planetary Institute and the Division of Educational Programs as well as the DSLS. The Institute and Divisions share access to a computing center, an image-processing facility, an extensive library, publishing services, and facilities for workshops and conferences. A 185-seat lecture hall is used extensively for Space Medicine Grand Rounds and other seminars. CASS is represented with a homepage on the World Wide Web URL: http://cass.jsc.nasa.gov/cass_home.html

Internet users can log on to CASS to get on-line information about upcoming meetings or send mail requesting more information to: DSLS@CASS.jsc.nasa.gov

SPECIAL PROGRAMS

Microgravity Vestibular Investigation Project, 1990-1993

The DSLS played a key role in coordinating activities and travel for the 13-member group of vestibular researchers from the U.S., Canada, U.K., France, and Japan, whose suite of studies on adaptation of the vestibular and ocularmotor systems to the microgravity environment of space flight flew onboard the first International Microgravity Laboratory Mission (IML-1) on STS-42 in January of 1992. The DSLS issued subcontracts with universities to support experiments that determined the effects of microgravity on visual suppression of the vestibulo-ocular reflex, changes in velocity, changes in the axis of eye movement during Optokinetic nystagmus (OKN) and Optokinetic After Nystagmus (OKAN), semicircular canal dynamics, memorized saccades, visual vestibular interaction, sensory perception, and a dynamic posture test and positional nystagmus.

Problems in dynamic postural control immediately after relatively short orbital missions raise concerns about egress capability after landing following an extended duration orbital (EDO) mission. Concurrently with his MVI investigations, Dr. Fred Guedry of the University of West Florida studied the perceived effects of head movements made during flight.

LIFENET, an Electronic Network for the Life Sciences, 1990-1991

From 1990 through 1991, the DSLS provided administrative and consulting services for LIFENET, a computer network designed to provide connectivity for the medical and space life sciences community. LIFENET provides an electronic mail system, file transfer, a bulletin board system, a user directory, a topic and comment board, a committee system for utilization of all LIFENET services for private groups, and access to the Internet and other networks. In addition to these features, LIFENET is designed to be completely menu-driven and user friendly. Because users call a local SprintNet telephone number that connects to NASA's PSCN network, user connectivity is free.

DSLS activities included project management and consulting, user enrollment and support, and publication of a manual and newsletters to enhance user connectivity.

International Programs Office, 1990-1993

The International Programs Office (IPO) served as an integral liaison between the Johnson Space Center Life Sciences Directorate and the international community of

researchers in the field of aerospace medicine and the the life sciences. The IPO provided technical translation and interpreting support for the U.S./U.S.S.R. Joint Working Group on Space Biology and Medicine and to the Russian-American space cooperation dealing with the docking of Mir and Shuttle and the exchange of crews. In support of the Shuttle Mir program, two cosmonauts spent one year at JSC for training. The IPO provided language translation during the training sessions and English lessons for the cosmonauts.

A two-month-long series of meetings in October and November 1993 between U.S. and Russian scientists and engineers was held in Houston to define the joint activities to be carried out onboard the U.S. Shuttle Orbiter and the Russian Mir Space Station. The IPO provided meeting coordination as well as translation and interpreting.

These meetings represented the end of the DSLS support of the Russian program. NASA issued an RFP to consolidate all of the U.S./Russian translation/interpretation task with a single contractor, to be a small business set aside. The principal USRA employees who comprised the IPO formed Tech Trans, Inc. and were awarded the new contract in December 1993 after a highly competitive bidding process.

NASA/UTMB Space Medicine Fellowship Program, 1993-1995

In 1992, a two-year postdoctoral fellowship in space medicine was established as a joint undertaking between the UTMB in Galveston and JSC. The DSLS was asked to facilitate this program, which is managed by an Executive Committee consisting of one member each from JSC, UTMB, and DSLS. The program has been very successful during the two years of its existence and routinely attracts many more applicants than the two positions available. The DSLS's unique position as a "non-competing" yet academically-oriented institution, the availability of the CASS facilities, and the DSLS's experienced administrative staff, have greatly facilitated the interaction between JSC and UTMB necessary for the program's operation, contributing significantly to its success.

HRF Visiting Scientist Program, 1994-95

The DSLS recently completed a successful recruiting effort for the new JSC HRF Visiting Scientist Program. The program, already scheduled to be expanded significantly this year, brings established life scientists to work onsite in JSC laboratories for three months to one year on projects of mutual interest to the visiting scientists and sponsoring JSC laboratory. It emphasizes research of operational significance and has an overall objective of expanding the scope of NASA's interaction with the academic community.

An inexpensive publicity campaign attracted over 40 highly qualified applicants from which two were selected. John Hoyer, M.D., worked with Dr. Peggy Whitson, head of the JSC Regulatory Physiology Laboratory, to investigate recently-discovered normal

urinary proteins as possible inhibitors of renal stone formation during space flight. John Schreiber, M.D., worked with Dr. Duane Pierson, head of the JSC Microbiology Laboratory, to investigate the effects of microgravity on the host response to T-independent bacterial polysaccharides. Neither visiting scientist had prior collaboration with NASA, yet both made substantial contributions to the JSC laboratories' programs.

Selection has been completed for the 1995-1996 HRF Visiting Scientists. An outstanding field of 36 candidates submitted applications, and JSC lab heads reduced the applicants down to six finalists for the two available positions. The two scientists selected are J. Lawrence Katz, Ph.D., Professor of Biomedical Engineering at Case Western Reserve University, who will work with Dr. Laurie Webster in the Musculoskeletal Laboratory, and Andrea M. Dietrich, Ph.D., Associate Professor of Civil Engineering, Virginia Polytechnic Institute and State University, who will work with Dr. Dick Sauer in the Environmental Sciences laboratory.

Under DSLS's management, the pilot HRF Visiting Scientist Program has drawn upon the experience of the DSLS to establish the basic administrative machinery, including development of promotional materials, generation of comparative data on effectiveness of advertisements in specific journals, establishment of a Selection Committee, and acquisition of experience with the selection procedure.

SPECIAL ACTIVITIES

Conferences and Workshops

The DSLS has a wealth of experience coordinating conferences and symposia. The CASS, with its 185-seat lecture hall equipped with state-of-the-art sound and projection capabilities, flexible large meeting rooms, small conference rooms, and extensive computer equipment for e-mail and use by meeting participants, is an excellent location for conferences and workshops. The experienced DSLS staff, plus the corporate knowledge and resources of the CASS, assure that every conference or meeting is managed successfully.

From 1990-1994 the DSLS managed and coordinated Space Radiation Research Workshops. Attendance at this annual international workshop grew to some 140 participants. The DSLS handled registration and logistics, travel arrangements, and publication of an abstract booklet. Two workshops were held in Houston at the Nassau Bay Hilton Hotel and one was held at CASS. Another was held in Dallas, Texas in conjunction with the Radiation Research Society Conference. These workshops proved to be a highly effective means of sharing data within the discipline.

Examples of symposia managed by the DSLS include both the Tenth and the Twelfth Frontiers of Clinical Pharmacology, which were cosponsored with the American College of Clinical Pharmacology (ACCP). Each year, ACCP chooses a new or "frontier" area for in-depth study. In 1990 the Tenth Frontiers focused on "Clinical Pharmacology in Space," while in 1992 the Twelfth Frontiers continued to study space adaptation with "Pharmacology Beyond Earth's Boundaries." The DSLS staff published and mailed a registration brochure/agenda to over 500 life scientists and students; negotiated hotel, catering, and transportation arrangements; arranged for audio taping of the presentations; arranged for a poster session and published an abstract booklet of the poster presentations; and registered attendees. Proceedings of each symposium were published, with the assistance of the DSLS, as monthly issues in the ACCP's *Journal of Clinical Pharmacology*.

The DSLS also managed the National Space Grant College and Fellowship Program Space Life Sciences (SLS) Symposium, held May 22-25, 1994 at CASS. The SLS Symposium offered university attendees the opportunity to exchange information on research and educational activities in the space life sciences. The DSLS performed extensive administrative planning and coordination for the symposium, including mailing letters of invitation, planning the agenda, negotiating hotel and transportation arrangements, arranging for onsite meals, receptions, and an offsite banquet, registering all attendees, and processing all travel and registration paperwork. Some 150 attendees from colleges and universities across the nation and from industry participated in the Symposium to hear NASA discipline scientists explain their research and discuss how collaborative relationships are formed.

In September 1995 the DSLS arranged and coordinated the International Workshop on Cardiovascular Research in Space with NASA Headquarters and the University of Texas Southwestern Medical Center in Dallas, Texas. Some 60 researchers from the United States, Canada, Europe, and Japan attended the intensive three-day workshop to discuss issues to be studied on the International Space Station. DSLS' duties included announcing and publicizing the workshop, arranging for travel and logistics, facilitating publication of a conference proceedings by taping presentations, and processing all travel and registration paperwork.

Discipline Meetings and Joint Working Groups

Topical workshops are an excellent means of involving the larger academic community in problems of interest to NASA life sciences investigators, and working group meetings allow participants to complete specific tasks and agenda items. The DSLS has extensive experience supporting both types of meetings and CASS facilities offer groups of 50 to 100 people ample accommodations for both splinter and plenary sessions. Working groups have used CASS computer facilities to produce documents and protocols. Support for these workshops has also included issuing invitations, publishing abstracts, making travel arrangements, purchasing meeting supplies, planning agendas, and other logistical support.

Examples of discipline meetings and working groups coordinated by DSLS include:

Microgravity Vestibular Investigations Co-Investigator Working Group Meeting, January 23-24, 1991

Space Life Sciences Consortium Organizational Meeting, January 25, 1991

Splinter Group Neuroscience Discipline Working Group meeting, February 25-26, 1991

Regulatory Physiology Discipline Working Group Ancillary Meeting, March 27-28, 1991

Behavioral Performance and Human Factors Discipline Working Group Subgroup, March 27-28, 1991

Regulatory Physiology Discipline Working Group, April 9-10, 1991

Second Annual Investigators Meeting on Radiation Research, April 22-23, 1991

Science Working Group Meeting, June 26-27, 1991

Circadian Rhythm Workshop, July 9-10, 1991

Educational Workshop for Elementary School Teachers, July 25, 1991

Life Sciences Countermeasures Workshop, December 16, 1991

Science Working Group Meeting, January 14, 1992

5th Annual Space Radiation Health Investigators' Meeting, CASS, April 26-28, 1994

Teacher Review Team Meeting, *Human Physiology in Space*, Dallas, July 29-30, 1994

Joint Mission Science Working Group, CASS, August 29-September 2, 1994

Environmental Sensors Workshop, CASS, September 22-23, 1994

US/Russian Joint Working Group, CASS, October 17-20, 1994

Human Research Facility (HRF) Science Working Group, January 17-19, 1995

Nutrition Workshop, March 27-28, 1995

International Cooperation Conference, April 25-27, 1995

HRF Science Working Group, May 15-16, 1995

U.S./Russian Joint Science Working Group, May 30-June 9, 1995

Summer Teacher Enhancement Program (STEP) Meeting, July 16-August 5, 1995

HRF Radiation Workshop, July 27-28, 1995

International life Sciences Hardware Workshop, August 2-3, 1995

Exercise Countermeasures Discipline Working Group, August 17-18, 1995

Meetings

Meetings in support of NASA life sciences research are often held at CASS. Support for these meetings, as well as for those scheduled at other locations in and around JSC or in locations across the country, can include issuing invitations, making travel arrangements, purchasing meeting supplies, planning agendas, and other logistical support.

Meetings supported during the contract include:

Media Training Workshop, May 8, 1991

SLS-1 Mission, May 22, 1991

Microgravity Vestibular Investigations Co-Investigator Meeting, July 28-August 2, 1991

Microgravity Vestibular Investigations Baseline Data Collection, August 22-26, 1991

Microgravity Vestibular Investigations Training Tour Meeting, August 25, 1991

Aerospace Medicine Advisory Committee Meeting, September 22-25, 1991

Microgravity Vestibular Investigations Meeting, October 5-8, 1991

Microgravity Vestibular Investigations Meeting, October 12-14, 1991

Aerospace Medicine Advisory Committee Meeting, October 16-18, 1991

Hydrazine Coalition Meeting, November 25-26, 1991

Astronaut Selection Meeting, December 3-20, 1991

Microgravity Vestibular Investigations Baseline Data Collection, December 10-29, 1991

Microgravity Vestibular Investigations STS-44 launch and Landing, January 22-29, 1991

Neuro-Otological and Spatial Awareness, February 7-10, 1992

Science Peer Review Meeting, March 11-13, 1992

Food Microbiology Meeting, CASS, December 1-2, 1993

Life Sciences Concurrent Engineering, CASS, December 3, 1993

Biotechnology Facility Meeting, CASS, December 6-10, 1993

Common Sense Approach to Grant Writing, CASS, December 9, 1993

Telemedicine Meeting, Washington, D.C., December 13-14, 1993

Iowa State/NASA/JSC Meeting, CASS, December 16, 1993

Microbiology Retreat, CASS, December 21, 1993

Common Sense Approach to Grant Writing, CASS, January 7, 1994

Rhesus Biocosmos Meeting, Paris, France, February 17-18, 1994

Space Medicine Fellowship Interviews, CASS, February 18, 1994

Biotechnology Facility Meeting, CASS, February 24, 1994

GASMAP Critical Design Review, CASS, March 1-2, 1994

SMSP Instrument Advisory Group, CASS, March 7-8, 1994

Centrifuge Facility *Ad Hoc* Review Panel, Washington, D.C., May 3-5, 1994

Animal Use and Care *Ad Hoc* Review Panel, Washington, D.C., May 31, 1994

Working with Russians, CASS, May 26-31, 1994

Italian Space Agency, CASS, May 31, 1994

Space Medicine Fellowship Orientation for New Fellows, CASS, July 5, 1994

Working with Russians, Regents Park III, July 21, 22, 25, 26, 1994

Negotiating with Russians, Regents Park III, July 28-29, 1994

OLMSA, Johnson Space Center, Kennedy Space Center, Ames Research Center,
July 31-August 3, 1994

Negotiating with Russians, CASS, August, 24, 1994

Cross Cultural Meeting of Astronauts/Cosmonauts, JSC 4S, October 10-14, 1994

GASMAP Critical Design Review, CASS November 30-December 2, 1994

Space Medicine Fellowship Interviews, March 3, 1995

Common Suit Program Meeting, March 13-17, 1995

Imaging Discussion Group, May 9, 1995

Space Medicine Fellowship Orientation, July 5, 1995

Seminars

Seminars are an integral part of a good scientific research environment. They provide timely communication of scientific results long before data can be published, provide communication of data that may never be published but may provide important information nonetheless, promote multidisciplinary understanding of problems and their potential solutions; encourage researchers to organize and present their data, provide a forum for critical peer reviews, and provide an opportunity for in-house scientists to consult with the guest speakers. DSLS involvement in these seminars can include issuing invitations to potential speakers, arranging for their travel, publicizing the seminar, and scheduling appointments for the seminar speaker to meet JSC discipline scientists and laboratory heads.

Varied types of seminars have been offered by the DSLS. A DSLS Seminar Series featuring lectures by visiting researchers and invited speakers has been an ongoing and integral part of the DSLS throughout its existence. A Research-in-Progress Seminar Series presented by SBRI investigators proved to meet a definite need for formal seminar-type communication among in-house investigators.

A Distinguished Lecturer Series, consisting of world-class scientists speaking on topics of interest to JSC researchers, has drawn considerable interest and excitement. William C. Dement, M.D., Ph.D. presented the first distinguished lecture "Changing the Way Society Deals with Sleep." On February 2, 1992, Robert W. Schrier, M.D. discussed "Body Fluid Volume Regulation in Health and Disease: A Unifying Hypothesis." Ian P. Howard, Ph.D., discussed "Mechanisms of Human Spatial Orientation on Earth and in Space" on December 15, 1992.

Finally, Space Medicine Grand Rounds, held in conjunction with the Space Medicine Fellowship program, has proven a productive information exchange between NASA life sciences community and the University of Texas Medical Branch, cosponsors of the Fellowship.

Seminars arranged during the DSLS contract are listed in Appendix V.

Travel Arrangements for Research and Education

The DSLS staff has extensive experience arranging travel, both domestic and foreign, for visiting scientists, consultants, and honorarium recipients. The research and educational travel program enables visiting scientists, staff scientists, and non-government employees to interact with their colleagues, hear scientific presentations, present papers, attend courses, and perform activities of interest to NASA. The DSLS has also been asked to arrange travel for committees doing NASA site visits, such as the Animal Use and Care Ad Hoc Committee and the Bioethics Task Force.

SIGNIFICANT RESULTS: FINDINGS, PROCEEDINGS, AND PUBLICATIONS

Findings

DSLS Visiting Scientists published the following articles in refereed journals during the contract period:

Charles, J.B. and *Lathers, C.M.*, "Cardiovascular Adaptation to Space Flight. Eds. C.M. Lathers and J.B. Charles. Journal of Clinical Pharmacology 31:1010-1023, 1991.

Charles, J.B. and *Lathers, C.M.*, "Summary of Lower Body Negative Pressure Experiments during Space Flight," Journal of Clinical Pharmacology 34, 571-583, 1994.

Coats, A.C., "Computer-Quantified Positional Nystagmus in Normals," Am J Otol, 14:314-326, 1993.

Frey, M.A., *Lathers, C.M.*, Davis, J., Fortney, S., Riddle, J., Steinmann, L., and Charles, J.B., "Hydration State and the Cardiovascular Response to the Stand Test," Journal of Clinical Pharmacology, 34, 387-393, 1994.

Gantenbein, R.E., Lawrence, T.F., and Shin, S.Y., "Adaptive Fault Management in Survivable Distributed Systems," International Journal of Reliability, Quality, and Safety Engineering, 1, 3, 391-412, 1994.

Gretebeck, R.J., Siconolfi, F.S., Rice, B., Lane, H.W., "Physical Performance is Unaffected by the Diet Provided for U.S. Astronauts during Space Flight," Aviation, Space & Environmental Medicine, 65(11), 1036-40, 1994.

Lane, H.W., *Gretebeck, R.J.*, "Metabolic Energy Required for Flight," Advances in Space Research, 14(11), 147-155, 1994.

Lane, H.W., Rice, R., Kloeris, V., Frye, S., Siconolfi, S.F., Spector, E., and *Gretebeck, R.J.*, "Effects of a Space Shuttle Diet on Body Weight and Composition in Healthy Active Women," Journal of the American Dietetic Association, 94, 87-88, 1994.

Lathers, C.M. and Charles, J.B., "Use of lower Body Negative Pressure to Counter Symptoms of Orthostatic Intolerance in Patients, Bed Rest Subjects, and Astronauts," Journal of Clinical Pharmacology, 33:1071-1085, 1993.

Lathers, C.M. and Charles, J.B., "Comparison of Echocardiographic Data Using 50 Head-Down Tilt and Space Flight," Journal of Clinical Pharmacology, 34, 489-499, 1994.

Lathers, C.M. and Charles, J.B., "Mechanisms of and Treatment for Orthostatic Intolerance in Patients, Bed Rest Subjects, and Astronauts," Journal of Clinical Pharmacology, 34, 403-417, 1994.

Lathers, C.M., Charles, J.B., Mukai, C.N., Riddle, J.M., Jacobs, F., Bennett, B.S., Lewis, D., Fortney, S., Frey, M.A., Stricklin, M.D., "Use of Lower Body Negative Pressure to Assess Changes in Orthostatic Heart Rate Response during 17 Weeks of Bed Rest," Journal of Clinical Pharmacology, 34, 563-570, 1994.

Lathers, C.M., Charles, J.B., Putcha, L., "The 12th Frontiers Symposium: 'Pharmacology Beyond Earth's Boundaries,'" Journal of Clinical Pharmacology, 34, 361-362, 1994.

Lathers, C.M., Diamandis, P.H., Riddle, J.M., Mukai, C., Elton, K.F., Bungo, M.W., and Charles, J.B., "Orthostatic Function During a Stand Test Before and After Head-Up and Head-Down Bed Rest," Journal of Clinical Pharmacology, 31:893-903, 1991.

Lathers, C.M., Riddle, J.M., Mulvagh, S.L., Mukai, C., Diamandis, P.H., Dussack, L.G., Bungo, M.W., and Charles, J.B., "Echocardiography During Six Hours of Bed Rest at Head-Down and Head-Up Tilt: Comparison to Space Flight," Journal of Clinical Pharmacology, 33:535-543, 1993.

Lathers, C.M., Schraeder, P.L., and Tumer, N., "The Effect of Phenobarbital Upon Autonomic Function and Epileptogenic Activity Induced by the Hippocampal Injection of Penicillin in Cats," Journal of Clinical Pharmacology, 33:837-844, 1993.

Mukai, C.N., Lathers, C.M., Charles, J.B., Bennett, B.S., "Cardiovascular Responses to Repetitive Exposure to Hyper- and Hypogravity States Produced by Parabolic Flight," Journal of Clinical Pharmacology, 34, 472-479, 1994.

Mukai, C.N., Lathers, C.M., Charles, J.B., Bennett, B.S., Elton, K.F., and Igarashi, M., "Acute Hemodynamic Responses to Weightlessness During Parabolic Flight," Journal of Clinical Pharmacology, 31:993-1000, 1991.

Schraeder, P.L., Lathers, C.M., and Charles, J.B., "Spectrum of Syncope," Journal of Clinical Pharmacology, 34, 454-459, 1994.

Zeitlein, C.J., Frankel, K.A., Gong, W., Heilbronn, L., Lampo, E.J., Leres, R., Miller, J., and Schimmerling, W., "A modular solid-state detector for measuring high energy heavy ion fragmentation near the beam axis," Radiation Measurement, 1, 65-81, 1994.

The following book chapters were published:

Lathers, C.M., "Digitalis glycosides," In: Textbook of Pharmacology. C.M. Smith and A.M. Reynard (eds.). Philadelphia, W.B. Saunders, 479-504, 1992.

Lathers, C.M. and O'Rourke, D.K., "Antiarrhythmic agents. In: Textbook of Pharmacology. C.M. Smith and A.M. Reynard (eds.). Philadelphia, W.B. Saunders, 505-553, 1992

Lonsbury-Martin, B.L., Martin, G.K., and Coats, A.C., "The physiology of the auditory and vestibular systems," In: Diseases of the Nose, Throat, Ear, Head and Neck, 14th Ed., Chapter 47. Ballenger JJ (ed.) Philadelphia, Lea and Febiger, 1991.

Coats, A.C., Martin, G.K., Lonsbury-Martin, B.L., "Vestibulometry," In: Diseases of the Nose, Throat, Ear, Head and Neck, 14th Ed., Chapter 48. Ballenger JJ (ed.) Philadelphia, Lea and Febiger, 1991.

Coats, A.C., "Vestibulometry," In: Diseases of the Nose, Throat, Ear, Head, and Neck, 15th Ed, Chapter 43. Ballenger JJ (ed.) Philadelphia, Lea and Febiger, (in press).

Schimmerling, W., "The Princeton-Pennsylvania Accelerator," in A History of Accelerator Radiation Protection: Personal and Professional Memoirs, Patterson, H.W., and Thomas, R.H., eds., Nuclear Technology Publishing, Kent, England, 1994.

The following articles appeared in conference proceedings:

Gantenbein, R.E., "Software-Implemented Fault Tolerance in Communication Systems," Proceedings Dual-Use Space Technology Transfer Conference, 1994.

Gantenbein, R.E., Roach, S., and Zimmerman, M., "Software Prototyping as a Tool for Evaluating Real-Time Fault Management Algorithms: A Case Study," Proceedings 12th Annual Conference of Association of Management, 92-97, 1994.

Gantenbein, R.E. and Shin, S.Y., "Using Multiple Fault-Tolerance Strategies in Survivable Systems," Proceedings ISSAT International Conference on Reliability and Quality in Design, 340-344, 1994.

Shin, S.Y., *Gantenbein, R.E.*, and Salehnia, A., "Using CASE Tools to Design Highly Reliable Software Systems," Proceedings ISSAT International Conference on Reliability and Quality in Design, 345-349, 1994.

DSLS Visiting Scientists published the following abstracts during the contract period:

Gilbert, J.H., Suire, S.S., *Gretebeck, R.J.*, Wong, W.W., Siconolfi, S.F., "Effect of Frequency, Circuit Analysis and Instrument on Extracellular and Total Body Resistance," Medicine and Science in Sports and Exercise, in press.

Gretebeck, R.J., Schoeller, D.A., Davis-Street, J., Shulz, L.O., Socki, R.A., Gibson, E.K., and Lane, H.W., "Background Correction Techniques for Doubly Labeled Water When Drinking Isotopically Enriched (Space Shuttle) Water," The FASEB Journal, 8:A725, 1994.

Lathers, C.M., Charles, J.B., Schneider, V.S., "Plasma Volume (PV) Response during 17 Weeks of Bed Rest (BR)," The FASEB Journal, submitted 1994.

Lathers, C.M., Levin, R.M., Spivey, W.H., "Coronary Occlusion Effect on Myocardial Beta Receptor Density, Heart Rate, and Blood Pressure in Cats after Labetalol Treatment for 1, 2, or 8 Weeks," Journal of Clinical Pharmacology, 34, 1994.

Lathers, C.M. and Schraeder, P.L., "Clinical Pharmacology Problem Solving (CPPS) Unit: "Clinical Pharmacology of Antiepileptic Drug Use, Clinical Pearls about the Perils of Patty," The FASEB Journal 8, A3268, 1994.

Siconolfi, S.F., *Gretebeck, R.J.*, "The Effects of Body Fluid Shifts on Single and Multi-Frequency Bioelectrical Analyses," Medicine and Science in Sports and Exercise, 26(5):S202, 1994.

Siconolfi, S.F., *Gretebeck, R.J.*, Suire, S.S., Wong, W.W., "Validity of Using Body Density and Three Estimates of Body Water to Assess Fat, Fat-Free Mass, Mineral, and Protein from Three-Compartment (C) Models," Medicine and Science in Sports and Exercise, in press.

Wilson, J.W., Thibeault, S.A., Cucinotta, F.A., Kim, M., Kiefer, R., and *Schimmerling, W.*, "Effects of Shield Properties on Cell Transformation in C3H10T 1/2. 42nd Annual Meeting of the Radiation Research Society, April 29-May 4, 1994, Nashville, TN.

DSLS visiting scientists edited the following articles during the contract period:

Bagian, J.P., "Cerebral Blood Flow: Comparison of Ground-Based Space and Flight Data and Co-Relation with space Adaptation. Eds. B.S. Bennett, *C.M.Lathers*, and

Money, K.E. and Cheung, B.S.K.: Alterations of Proprioceptive Function in the Weightless Environment. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:1007-1009, 1991.

Lloyd, C.W.: Space Medicine: Answering the Challenge. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:1027-1035, 1991.

Mulvagh, S.T., Charles, J.B., Riddle, J.M., Rehbein, T.L., Bungo, M.W.: Echocardiographic Evaluation of the Cardiovascular Adaptation Before and After Short Duration Space Flight. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:1024-1026, 1991.

Frey, M.A., Riddle, J., Charles, J.B., Bungo, M.W.: Blood and Urine Responses to Ingestion of Various Salt and Glucose Concentrations. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:880-887, 1991.

Fortney, S.M.: Development of Lower Body Negative Pressure as a Countermeasure for Orthostatic Intolerance. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:888-892, 1991.

Parker, D.E.: Human Vestibular Function and Weightlessness. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:904-910, 1991.

Tripp, L.D., Jr. and Chelette, T.L.: Cerebral Blood Flow +Gz Acceleration as Measured by Transcranial Doppler. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:911-914, 1991.

Leach, C.S., Inners, L.D., and Charles, J.B.: Changes in Total Body Water During Space Flight. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:1001-1006, 1991.

Leach, C.S., Cintron, N.M., and Krauhs, J.M.: Metabolic Changes Observed in Astronauts. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:921-927, 1991.

Santy, P.A. and Bungo, M.: Pharmacological Considerations for Shuttle Astronauts. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:931-933, 1991.

Kohl, R.L. and MacDonald, S.: New Pharmacological Approaches to the Prevention of Space/Motion Sickness. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:934-946, 1991.

Mader, T.M.: Intraocular Pressure in Microgravity. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:947-950, 1991.

Levy, G.: Pharmacodynamic Aspects of Space Flight. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:956-961, 1991.

Drusano, G.L.: Optimal Sampling Theory and Population Modeling: Application to Determination of the Influence of the Microgravity Environment on Drug Distribution and Elimination. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:962-967, 1991.

Amidon, G.L., DeBrincat, G.L. Najib, N.: Effect of Gravity on Gastric Emptying, Intestinal Transit and Drug Absorption. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:968-973, 1991.

Vernikos, J., Dallman, M.F., Van Loon, G., and Keil, L.C.: Drug Effects on Orthostatic Intolerance Induced by Bedrest. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:974-984, 1991.

- Bugg, C.E. and DeLucas, L.J.: Protein Crystal Growth in Microgravity. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:985-987, 1991.
- Walker, C.D.: Pharmaceutical R&D in Space: An Industry Perspective. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:988-992, 1991.
- Eckberg, D.L. and Fritsch, J.M.: Human Autonomic Responses to Actual and Simulated Weightlessness. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:951-955, 1991.
- Schmitt, H.: A Biomedical Trip to the Moon and Beyond. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:928-930, 1991.
- Bondar, R. et al. Cerebral Blood Flow Velocities by Transcranial Doppler During Parabolic Flight. Eds. C.M. Lathers and J.B. Charles. *J Clinical Pharmacol.* 31:915-919, 1991.
- Bagian, JP. First Intramuscular Administration in the U.S. Space Program. *J Clinical Pharmacol.* 31:920, 1991.
- Williams, P.B.: Incorporation of Clinical Pharmacology into the Fourth Year of the Medical Curriculum: Teaching Clinical Pharmacology Without a Clinical Pharmacologist. Series Eds. C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol.* 30:1065-1073, 1990.
- Hutcheon, D.E. and Wadie El-Gawly, Hoda: A Computer-Based, Problem Solving System of Instruction in Clinical Pharmacology. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 31:198-204, 1991.
- Burford, H.: Innovative Approaches to Teaching Clinical Pharmacology: Problems of an Emerging Curriculum. Series Eds. C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol.* 31:423-428, 1991.
- Spilker, B.: Teaching Courses in Clinical Trial Research Methods. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 31: 496-508, 1991.
- Pina, I.L., Spitzer, S., Porter, R.S., Michelson, E.L.: Clinical Pharmacology Education in a Division of Cardiology. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 31:599-606, 1991.
- Robertson, D.: The Role of the General Clinical Research Center in Teaching Clinical Management. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 31:691-696, 1991.
- Eisenberg, R.: MacPharmacology: A series of computerized study and review programs. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 32:10-17, 1992.
- Nelson, R. And Peck, C.: Clinical Pharmacology Training at the Food and Drug Administration. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 32:400-406, 1992.
- Ingenito, A.J., Nobel, B.G., and Wooles, W.R.: The Case Conference Approach to Teaching Clinical Pharmacology. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 32:502-520, 1992.
- Calderwood, J.A. and Johnson, J.M.: A Legal Curriculum for the Clinical Pharmacologist. I. Order of Precedence of Authority. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 32:1073-1082, 1992.

Calderwood, J.A. and Johnson, J.M.: A Legal Curriculum for the Clinical Pharmacologist. II. The Court System and Grants and Contracts. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 33:22-28, 1993.

Burford, H.J., Balfour, D.J.K., Stevenson, I.H.: Development of PharmTest: A Unique Faculty Tool for Assessment. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 33:400-404, 1993.

Mackichan, J.J. and Shield, B.J.: A One-Month Drug Analysis Laboratory Rotation for Doctor of Pharmacy Students. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 33:790-798, 1993.

Johnson, J.M. and Tanner, L.A.: Adverse Drug Experience Reporting: Educating the Hospital Clinical Pharmacologist. Part I. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 33:904-911, 1993.

Johnson, J.M. and Tanner, L.A.: Adverse Drug Experience Reporting: Educating the Hospital Clinical Pharmacologist. Part II. Series Editors, C.M. Lathers and A.J. Ingenito. *J Clinical Pharmacol* 33:1015-1022, 1993.

The following articles were under review or in press in 1995:

Gretebeck, R.J., Schoeller, D.A., Gibson, E.K., and Lane, H.W., "Energy Expenditure during Antiorthostatic Bed Rest (Simulated Microgravity)," Journal of Applied Physiology, in review.

Schimmerling, W., Wilson, J.W., Nealy, J.E., Thibeault, S.A., Cucinotta, F.A., Shinn, J.L., Kim, M., and Kiefer, R., "Shielding against Galactic Cosmic Rays," Advanced Space Research, in press.

Schimmerling, W., "Space and Radiation Protection: Scientific Requirements for Space Research," Environmental Biophysics, in press.

Schoeller, D.A., Gretebeck, R.J., Gibson, E.K., Schulz, L.O., Lane, H.W., "Doubly Labeled Water in Subjects Exposed to a New Source of Water," Journal of Physiology, in review.

Siconolfi, S.F., Gretebeck, R.J., Wong, W.W., "Assessing Total Body Mineral, Bone Mineral Content, and Total Body Protein from Total Body Water and Body Density," Journal of Applied Physiology, in review.

Siconolfi, S.F., Gretebeck, R.J., Wong, W.W., Pietryk, R.A., Suire, S.S., "Assessing Total Body and Extracellular Water from Bioelectrical Response Spectroscopy," Journal of Applied Physiology, in review.

Wilson, J.W., Kim, M., Schimmerling, W., Badavi, F.F., Thibeault, S.A., Cucinotta, F.A., Shinn, J.L., and Kiefer, R., "Issues in Space Radiation Protection: Galactic Cosmic Rays," Health Physiology, in press.

Proceedings

From time to time, the DSLS has published, and facilitated publication of, proceedings of symposia, workshops, and meetings. The DSLS published the Proceedings of the Space Life Sciences Consortium Organizational Meeting, held

January 25, 1991. Those proceedings documented interest in forming a Consortium, as well as offering participants an overview of the life sciences research performed by JSC's Space Biomedical Institute and Biomedical Operations and Research Branch.

Proceedings of the 10th Frontiers Symposium, "Clinical Pharmacology in Space," cosponsored by The American College of Clinical Pharmacology and the DSLS were published as the October 1991 issue of *The Journal of Clinical Pharmacology*. Visiting Scientist Dr. Claire Lathers edited the peer-reviewed issue.

Proceedings of the 12th Frontiers Symposium "Pharmacology Beyond Earth's Boundaries" that was held May 6-8, 1992 at the Center for Advanced Space Studies and cosponsored by The American College of Clinical Pharmacology and the DSLS were published as the May and June 1994 issues of *The Journal of Clinical Pharmacology*. Both peer-reviewed issues were edited by Visiting Scientist Dr. Claire Lathers.

Proceedings of the 1995 International Workshop on Cardiovascular Research in Space will be published in *Medicine and Science in Sports and Exercise*, the official journal of the American College of Sports Medicine. The DSLS facilitated publication by arranging for audio taping of workshop presentations and by providing those tapes to the participants to aid them with manuscript preparation.

Special Format Publications

Special format publications such as abstract booklets and syllabi can serve as valuable adjuncts to conferences and workshops. The DSLS compiled and published booklets of abstracts for the Space Radiation Health Investigators' Workshops from 1991 through 1994. In addition, the DSLS published abstract booklets for the 12th Frontiers of Clinical Pharmacology Symposium in 1992 and the 1994 Environmental Sensors Meeting. The DSLS also published extensive presentation notebooks for participants in the 1994 National Space Grant College and Fellowship Program Space Life Sciences Symposium and the 1995 International Workshop on Cardiovascular Research in Space.

Update of Human Physiology in Space: A Program for America

A modified and enhanced version of this textbook, *Human Physiology in Space: A Program for America*, was developed under the direction of DSLS Visiting Scientist Barbara Lujan and sponsored by NASA, the National Institutes of Health (NIH), USRA, and the University of Texas Southwestern (UTSW) Medical Center in Dallas. The text was printed through the U.S. Government Printing Office.

The materials, which were prepared as a supplement to a high school biology, health science, or physiology curriculum, present elements of the emerging fields of

space physiology and space biology at a level that can be clearly understood by students in this age group. The textbook is produced in both a Teacher's and a Student's version. A multidisciplinary approach, utilizing the principles of biology, chemistry, physics, and mathematics, is used to describe how the human body functions and how it changes and adapts to the environmental differences encountered in space. The lessons are built around the results of actual space flight experiments that have been carried out on the space shuttle in recent years.

The textbook was featured in a demonstration project in about 50 high school classrooms in the Dallas/Ft. Worth area during the spring of 1995. Input from these teachers and those teachers from New Mexico who took part in the text's first edition classroom pilot project was incorporated into this new edition.

SPACE LIFE SCIENCES CONSORTIUM

In late 1990 USRA organized a group of academic institutions with an expressed interest in promoting and enhancing interaction between NASA Space Life Sciences and themselves. The Space Life Sciences Consortium (Appendix VIII), as it is called, has grown to 41 members (four outside the U.S.).

University of Alabama in Huntsville
University of Arizona
Baylor College of Medicine
Boston University School of Medicine
Brandeis University
University of California, Los Angeles
University of California, San Diego
Case Western Reserve University
Centre National de la Recherche Scientifique (France)
Good Samaritan Hospital & Medical Center, Portland, Oregon
University of Houston, Downtown
University of Houston, Clear Lake
Lehigh University
Los Alamos National Laboratory
Massachusetts Institute of Technology
McGill University (Canada)
Miami University
Mayo Clinic, Rochester, Minnesota
University of Michigan
Michigan State University
University of Minnesota
Mt. Sinai Medical Center

National Institutes of Health
• National Institute on Deafness & Other Communication Disorders
• National Institute of Neurological Disorders and Stroke
• Office of Science Policy and Legislation
Pennsylvania State University
RAF Institute of Aviation Medicine (U.K.)
Rensselaer Polytechnic Institute
Rice University
University of Sheffield (U.K.)
Stanford University
Texas A&M University System
Uniformed Services University of the Health Sciences
University of Texas, Austin
University of Texas Health Science Center at Houston
University of Texas Health Science Center at San Antonio
University of Texas Medical Branch at Galveston
University of Texas Southwestern Medical Center
Vanderbilt University
Wright State University

The first meeting of consortia members was held January 25, 1991 in Houston, TX. Representatives from both the Consortium and from the NASA life sciences community met to develop ideas and to define the Consortium's organizational structure and operation. Both sides expressed enthusiasm over the prospect of a potential "clearing house" for dissemination of information and exchange of personnel.

Consortium Newsletter

Information about NASA life sciences in general, and ongoing space biomedical research and research opportunities in particular, is disseminated in the *Space Life Sciences Newsletter*, published by the DSLS. Members of the Consortium and any others interested in the subject matter have been added to the *Newsletter* distribution list. Recent articles have focused on the JSC Exercise Countermeasures Project, the practice of Space Medicine as a specialty, and differences between life sciences research as supported by NASA and the National Institutes of Health.

DSLS SCIENCE COUNCIL

Each institute, center, division, or program of USRA is overseen by a Science Council that serves, in effect, as a scientific board of directors. Each Science Council provides guidance in the discipline area for which it is responsible. Members are appointed to three-year terms by the USRA Board of Trustees on the basis of their scientific expertise and their standing within the academic community.

Members of the DSLS Science Council include:

Bobby R. Alford, M.D.
(convener)
Baylor College of Medicine
Houston, Texas

James Lackner, Ph.D.
Brandeis University
Waltham, Massachusetts

F. Owen Black, M.D.
Good Samaritan Hospital
Portland, Oregon

M. David Low, M.D., Ph.D.
University of Texas Health Science Center
Houston, Texas

Alfred C. Coats, M.D.
(*ex officio*)
USRA-DSLS and
Baylor College of Medicine
Houston, Texas

Charles Oman, Ph.D.
Massachusetts Institute of Technology
Cambridge, Massachusetts

Michael Holick, M.D.
Boston University School of Medicine
Boston, Massachusetts

Harrison Schmitt, Ph.D.
Albuquerque, New Mexico

Thomas James, M.D.
University of Texas Medical Branch
Galveston, Texas

Scott Swisher, M.D.
Michigan State University (emeritus)
East Lansing, Michigan

CONTRACT INFORMATION

Contract Status

In November 1990, the NASA Lyndon B. Johnson Space Center's Space and Life Sciences Procurement Branch awarded Universities Space Research Association's Division of Space Life Sciences the NASA contract for Space Life Sciences Research and Education Support (NAS9-18440).

The period of performance for contract NAS9-18440, December 1, 1990 to November 30, 1995, was later revised to end on September 30, 1995 due to the man-hour limitation. The basic contract value was \$15,234,200, to which five one-year options for incremental increase of effort could be added. The options for incremental increase in effort allowed the Government to increase the number of man-hours during any individual one-year period of performance by an amount ranging from 1 to 25,000 man-hours. The five one-year options added to the basic contract value equaled a maximum total contract value of \$22,222,500.

The first year's option to increase the number of man-hours was not exercised; the second year's option to increase man-hours was exercised in October 1992. The third year's option was exercised in March 1993, while the fourth year's option was exercised in June 1994. The fifth year's option to increase man-hours was exercised in January 1995. Therefore, the addition of four years of incremental increase in man-hours added to the basic contract value brought the total contract value to \$21,245,950.

During property audits conducted in 1993, 1994, and 1995, the DSLS received performance ratings of "Satisfactory."

Financial Status

Figure I (Appendix VI, page 62) illustrates actual monthly expenditures for the Division of Space Life Sciences for the period December 1, 1990 through September 30, 1995 along with the funding level through Mod 76 and the contract value with Option 5 exercised. The graph shows that funding has always exceeded expenditures and that the contract value was adequate.

Figure II (Appendix VII, page 64) shows the labor hours associated with the DSLS from December 1, 1990 through September 30, 1995. The DSLS contract was a level of effort contract with 272,050 (through Option 5) total labor hours, plus or minus five percent. The solid line on Figure 2 represents the band of authorized labor hours

with each option, and the other line represents the total hours expended. The hours status was very close to the total hours ceiling, resulting in an early termination of the contract effective September 30, 1995.

DSLS PERSONNEL

Directors

Dr. Coats is a professor in the departments of Otolaryngology/Communicative Sciences and Neurology at Baylor College of Medicine in Houston, Texas. He has authored or coauthored more than 60 papers in refereed journals and has contributed to 15 books. His research and clinical interests are in clinical testing of neurophysiologic function with emphasis on the inner ear. However, his scientific interests and knowledge span a wide range of topics. He assumed the DSLS directorship in 1991 and currently devotes 50% of his time to the DSLS.

John R. Sevier first served in a research capacity at NASA's Langley Research Center and later in various engineering and science management capacities at the JSC. He chaired the Lunar Traverse Planning Team for the Apollo program and was the Deputy Program Scientist for the Skylab Mission. From 1975-1977 he was Chief of the Integration Division in the Program Operations Office at JSC. He received the NASA Exceptional Service Medal in 1972 and the NASA Medal for Scientific Achievement in 1973. He joined USRA in August 1977 as Associate Director of the Lunar and Planetary Institute (LPI). He served as Acting Director of the LPI in 1979. He has been the Deputy Director of the DSLS since 1983, and has been the Director of the Division of Educational Programs (DEP) since 1989. He recently became Program Manager of the Student Explorer Demonstration Initiative (STEDI) - a new program awarded to USRA to manage small, low cost, short-lead time space science missions initiated by undergraduate and graduate students. Mr. Sevier currently devotes 70% of his time to the DSLS.

Project Management

Ms. Terri Jones, Project Manager, has served as the daily interface between NASA and DSLS, providing oversight for assuring that administrative, budgetary, and logistical matters are handled effectively and efficiently.

Ms. Jones' current responsibilities include oversight of more than 100 tasks, some of which include subcontract administration, large research conferences, and multiple budgets. She has over 15 years of experience in managing critical administrative areas for various types of government contracts. Her last 10 years have been focused on government contract administration and project management. She has a B.S. in Education from New Mexico State University and an M.S. in Public Administration from

the University of Texas at Tyler. While serving as the Head of Administration and Facilities at the National Scientific Balloon Facility, she was responsible for the contract management of 11 different facilities contracts for construction for NASA, which accounted for \$4 million of the overall \$78 million contract. As a result of the success of these projects, Ms. Jones was awarded the NASA Public Service Group Achievement Award in May 1994. She devotes 100% of her time to the DSLS.

Ms. Jones has been assisted by other administrative and clerical staff who have coordinated NASA-sponsored meetings and workshops; arrange staff, visiting scientist, and subcontractor travel; prepared consultant and honoraria payments; administered subcontracts; and written, edited and published educational materials. This team has a wealth of experience in contract administration; conference, seminar and workshop management; visiting scientist recruitment and support; technical writing and editing; and scientific peer review implementation. In addition, a sixth staffer, Accounting Assistant Dana Nelson, is funded from corporate overhead and assigned to assist with DSLS accounting functions.

The DSLS staff consists of:

Tammie Willy	Project Administrator	100% time
Barbara Railsback	Administrative Secretary	100% time
Kay Nute	Editorial Assistant	80% time
Lisa Reed	Technical Specialist	80% time
Gail Pacetti	Travel and Meeting Coordinator	75% time

BUSINESS MANAGEMENT

Business management of this program has been the responsibility of USRA Headquarters, located in Columbia, Maryland. USRA Headquarters provides accounting and contract administration support and oversight for USRA-sponsored programs. Accounting functions are performed under the direction and supervision of Ms. Sheila Del Favero, Chief Financial Officer. Ms. Del Favero is a Certified Public Accountant and holds a master's degree in Management and Supervision, with a concentration in business administration. Ms. Del Favero has over 15 years of experience in accounting for government contracts.

Contract administration support and oversight functions are under the direction and supervision of Ms. Beverly Johnson, Procurement Officer. Ms. Johnson is a Certified Professional Contracts Manager and holds a master's degree in Business Administration, with a concentration in procurement and contract management. Ms. Johnson has 18 years of experience in procurement and contract management.

Corporate Attorney

USRA retains as its corporate attorney, Mr. William J. Butler, Jr., partner in the Washington, D.C., law firm of O'Brien, Birney, and Butler. Mr. Butler has extensive experience with nonprofit, scientific organizations, serving, for example, as the chief counsel for the American Chemical Society. Mr. Butler prepared the USRA Articles of Incorporation.

Cost Accounting

USRA uses the Deltek™ Government Contractor software series, which is a modular accounting system designed specifically for government contractors. The Deltek™ system automates all major accounting functions. The Deltek™ system at USRA Headquarters functions in a PC/LAN environment and operates with many off-site remote users at USRA's programs, divisions, and institutes. The Deltek™ integrated system includes modules for time sheets, payroll, general ledger, job costing, billings and accounts receivable, budgeting, and decision support.

Cost controls are accomplished through the purchase requisition module used to assist in monitoring budgets and tracking committed costs. This module provides an automated system whereby USRA determines whether or not funding is available prior to incurring costs.

Corporate Auditor

In addition to audit functions that are performed by the USRA Headquarters' staff auditor, all USRA fiscal records are audited by USRA's corporate auditor, Ernst and Young. The annual audit includes compliance with the requirement in OMB Circular A-133 for nonprofit and educational institutions. Ernst and Young performs an annual audit before fiscal records are submitted to USRA's cognizant audit agency, the DCAA:

DCAA

Mid-Atlantic Region

District Branch Office

8181 Professional Place, Suite 112

Landover, Maryland 20785-2218

(301) 436-1015

CONCLUDING REMARKS

Throughout the contract period, the DSLS has striven to achieve excellence in achieving its basic objective of expanding and improving interactions between NASA's Life Science Programs and the outside academic and scientific communities. Notable accomplishments toward this goal include the administration of several Microgravity Vestibular Investigation project working group meetings, co-sponsorship of the NASA/UTMB space medicine fellowship, and the establishment, and administration of the highly successful HRF Visiting Scientist Program. We also expanded our resources for coordinating conferences, symposiums and workshops and sponsored approximately 130 seminars, meetings, and conferences. In addition, our visiting and staff scientists published 77 scientific articles or abstracts and have another eight in press. We also published three proceedings and produced *Human Physiology in Space: A Program for America* - a highly successful textbook which supplements high school biology teaching materials with actual space flight data. We also established a Space Life Sciences Consortium, which has grown to thirty-seven institutional members located throughout the United States and an additional four foreign members. To facilitate communication with the Consortium members we have published a Consortium newsletter.

We look forward to continuing to apply the extensive resources that we have developed to the improvement and expansion of relationships between NASA Life Sciences and the external academic community.

APPENDIX I

VISITING SCIENTISTS

VISITING AND STAFF SCIENTISTS 1990 - 1995		
Name	Description of Work	Discipline Area
Richard Beatty, Ph.D. (Staff)	Establish an International Science and Technology Office to facilitate space flight research activities and involve the Russian scientific community in the research program.	Mission Planning/Program Architecture
Larry Biever, Ph.D. (Staff)	Provide management support for interface between NASA Programs and Flight Missions Branch and NASA Life Sciences Division, including facilitation of Life Science Branch's participation in flight mission planning and development of science and technological requirements documents.	Management
Phillip Bishop, Ed.D. (Visiting)	Develop exercise protocols for Space Shuttle flights for the Exercise Countermeasures Laboratory.	Exercise Physiology
Darlene Canales (Visiting)	Create three-dimensional tumor models for investigation of solid tumor invasion by human lymphocytes in vitro.	Environmental Science
Krishnan Chittur, Ph.D. (Visiting)	Build sensor systems for Space Shuttle bioreactor.	Biotechnology
David Cooper (Visiting)	Study lymphocytes in vivo and their response to infection and cancer in an activated state.	Biotechnology and Immunology
Marie Collin, Ph.D. (Visiting)	Develop computer modeling of vision and image analysis.	Computer Science
Scott Flechsig (Visiting)	Assist with engineering design, specification and implementation of biochemical sensing devices for cell growth reactors used in microgravity environments.	Biomedical Engineering
Rex Gantenbein, Ph.D. (Visiting)	Design and develop a flexible, real-time experiment control and data acquisition software system to support human experiments.	Neuroscience/Software Design and Development
Randall Gretebeck, Ph.D. (Visiting)	Design and conduct ground-based and flight experiments to study the effects of space flight in energy metabolism and body composition.	Nutritional Biochemistry
Kathy Haynes (Visiting)	Make tissue and cell culture 2-D electrophoresis of protein samples for inclusion in a database for identifying microgravity-induced proteins.	Cell Biology
Ramiro Iglesias, M.D. (Visiting)	Investigate NASA operational medicine techniques.	Cardiovascular Physiology
Lee Janson, Ph.D. (Visiting)	Investigate mechanism of microgravity-induced inhibition of immunological activation.	Immunology
Ojynan. Kolev, Ph.D. (Visiting)	Study motion sickness interdigestive myoelectric complex (IMC) reactions to motion stimuli.	Neuroscience
Jody Kravek (Visiting)	Assist in data collection and analysis for MVI and EDO investigations.	Neuroscience
Claire Lathers, Ph.D. (Visiting)	Conduct research in the autonomic and hormonal mechanisms of cardiovascular adaptation to microgravity.	Cardiovascular Physiology
Cecilia Lira (Visiting)	Study lymphocytes in vivo and their response to infection and cancer in an activated state.	Biology/Immunology

VISITING AND STAFF SCIENTISTS 1990 - 1995		
Name	Description of Work	Discipline Area
David R. Liskowsky, Ph.D. (Staff)	Provide administrative support for science planning in the neuroscience discipline of the NASA Space Physiology and Countermeasures Program.	Neuroscience/ Administration
Barbara Lujan (Staff)	Develop and produce high school science textbook entitled, Human Physiology in Space .	Life Sciences Education
Ralph Lydic, Ph.D. (Visiting)	Investigate changes in neural function resulting from spaceflight.	Anesthesiology/Neuro
Garry Marley, Ph.D. (Visiting)	Culture Glioma for Biotechnology Laboratory.	Biotechnology
John McCarthy, Ph.D. (Visiting)	Establish protocols for Exercise Countermeasures Laboratory.	Exercise Physiology
Satish Mehta, Ph.D. (Visiting)	Examine neutrophil function, cytotoxicity of NK/LAK cells, and cytokines.	Microbiology
Tatsuo Nakazato, M.D. (Visiting)	Study arterial and cardiopulmonary baroreflexes during continuous and intermittent head-down tilt and parabolic flight.	Cardiovascular Physiology
Fred Newton (Visiting)	Design a resistance training device for the Exercise Countermeasures Laboratory.	Biomedical Engineering
Francis J. Pirozzolo, Ph.D. (Visiting)	Study psychological effects of isolation and confinement.	Neuropsychology
Anil Raj, Ph.D. (Visiting)	Investigate device that provides motion and orientation information via somatic transducers. Evaluate and implement new eye motion tracking methods.	Neurophysiology
Beth Ryder (Visiting)	Assist with data collection and analysis to moderate the effects of readapting to 1-G.	Neurobiology
Walter Schimmerling, Ph.D. (Staff)	Provide management support for NASA Space Radiation Health and Radiation Biology Research Program.	Radiation Biology/ Administration
Howard Schneider, Ph.D. (Visiting)	Analyze proposed research programs and review experiment plans and data content for studies to be conducted.	Mission Management
Karl Simanonok, Ph.D. (Visiting)	Investigate and evaluate physiologic countermeasures to cardiovascular problems through computer simulation and investigate the potential use of synthetic analogs of vasopressin.	Cardiovascular physiology
Damien Simon (Visiting)	Develop and implement software analysis and data processing scripts using data obtained from the Motion Analysis Systems and software interface development.	Software Design
John Stewart, Ph.D. (Visiting)	Assist the Neurophysiology Laboratory with space motion sickness studies.	Pharmacology and Neurophysiology
Kwangjae Sung, Ph.D. (Visiting)	Port the eye image analysis algorithm developed at JSC onto a RISC-based personal computer.	Electrical Engineering
Bruce Towe, Ph.D. (Visiting)	Design, specify, and implement biochemical sensing devices for cell growth reactors used in microgravity environments.	Biotechnology
Peter Uchakin, Ph.D. (Visiting)	Examine the effects of stress on cytokine production and regulation in human immune cells.	Microbiology

VISITING AND STAFF SCIENTISTS 1990 - 1995		
Name	Description of Work	Discipline Area
Daniel von Deutsch, Ph.D. (Visiting)	Study effects of potential countermeasures to disuse or microgravity-induced muscle atrophy using differentiated primary human muscle cells.	Cell Culture
Jon Williams, Ph.D. (Visiting)	Investigate the role of the sympathoadrenal system and its control of the cardiovascular system in human physiological responses to simulated microgravity (head-down bed rest).	Cardiovascular Physiology
J. Wally Wolfe, Ph.D. (Staff)	Provide management support for neuroscience research activities within NASA, including development of science requirements statements for Neurolab.	Neuroscience/ Administration

APPENDIX II

CONSULTANTS

CONSULTANTS 1990 - 1995			
Name	Address	Description of Work	Discipline Area
W. Carter Alexander, Ph.D.	Floresville, TX	Provide expert assistance to JSC Space and Life Sciences Directorate for preparation of Science Program Management Plan.	Program Management
Gideon Ariel, Ph.D.	Trabuco Canyon, CA	Develop a new programmable resistive exercise device and validate its operation in terrestrial and microgravity environments.	Exercise Physiology
Tony Benton	Houston, TX	Develop inter-communications hardware and software for JSC Bio-technology facility.	Biotechnology
Roberta Bondar, M.D., Ph.D.	Toronto, Ontario Canada	Develop and evaluate Transcranial Doppler System and other instruments to simultaneously measure cerebrovascular, neuroendocrine and hemodynamic responses to standing before and after space flight.	Neurology/ Neurophysiology
Baruch Brody, Ph.D.	Houston, TX	In association with Bioethics Policy Task Force, prepare a policy manual and other documents related to the ethics of human subjects research at NASA.	Biomedical Ethics
Walter Burroughs	Rockville, MA	Produce <i>Human Physiology in Space</i> high school textbook.	Life Sciences Education
Paul Byrne-Dunhill	Dallas, TX	Design and develop Gas Locker.	Bioengineering
Mike Chambers	Allen, TX	Develop PC networking hardware and software for NASA/JSC Biotechnology facility.	Software Development
Marianne Merchez-Cheli, M.D.	Brussels, Belgium	Provide consultative and administrative support for integration of US and Russian life sciences research on the Shuttle/Mir Project.	General Life Sciences
Gilles Clement, Ph.D.	Paris, France	Investigate the effects of weightlessness on visual-vestibular interactions as coinvestigator of Microgravity Vestibular Investigation aboard IML-1.	Neurophysiology
Frank Crawley, Ed.D.	Austin, TX	Develop an evaluation process for the <i>Human Physiology in Space</i> textbook demonstration project; collect, organize, analyze, and summarize data.	Life Sciences Education
Charmaine Eastman Karen Stewart	Philadelphia, PA	Analyze Circadian shifts and schedule preflight light therapy for Space Shuttle missions.	Circadian Physiology
John Hooker, Ph.D.	Houston, TX	Analyze heart rate time series, applying nonlinear chaos measures to it.	Cardiovascular Physiology
David Horrigan	Houston, TX	Update existing data on requirements and plans for underwater, neutral buoyancy training at JSC.	Barophysiology
Phillip Foster, Ph.D.	Annecy, France	Investigate pulmonary mechanics and gas exchange in hyperbaric and hypobaric atmospheres and mechanisms of decompression sickness.	Barophysiology
Edward Jarmul, Ph.D.	Pensacola, FL	Develop an improved man-machine interface (vibrotactile stimulation). Design and test a force measuring device to measure strength of astronauts and pilots when performing routine and emergency procedures.	Biomedical Engineering
Eric Jones, Ph.D.	Los Alamos, NM	Produce Apollo Lunar Surface Journal - an annotated transcript of air-to-ground communications during lunar surface operations with commentary emphasizing EVA work experience and human factors issues.	Human Factors

CONSULTANTS 1990 - 1995			
Name	Address	Description of Work	Discipline Area
Kathryn Linenger	Seabrook, TX	Assist in the administration, planning and US-Russian coordination of science activities for Shuttle/Mir Mission, including training and baseline data collection.	Administration
Laurie Looper	Houston, TX	Study multicultural factors and their application to long-term space flight for Behavioral Laboratory.	Multicultural Factors
Braden McGrath	Pensacola, FL	Develop fluid and structural model of the horizontal semicircular canal system.	Neurophysiology/ Computer Modeling
Lee Neitzel	Kemah, TX	Develop software and hardware for computer intercommunication network for the NASA/JSC Bio-Technology Facility.	Software Development
Simone Palasciano	Fallbrook, CA	Provide consultation and engineering support for development of the Metabolic Gas Analyzer System to be flown on the Shuttle/Mir Mission.	Biomedical Engineering
Donald Parker, Ph.D.	Seattle, Washington	Analyze perceptual report data and develop animation devices to illustrate self-orientation perception and self-motion.	Neuroscience
Rob Peterson	Houston, TX	Develop "virtual instrumentation" approach to physiological measurements for human space flight. Design, build, and test engineering models of this measurement system.	Physiological Measurement System
Robert Phillips, Ph.D.	Fort Collins, CO	Provide administrative support for the Chief Scientist serving the Space Station program. Activities focus on the Shuttle-Mir program and International Space Station program.	Administration
John D. Probe	La Jolla, CA	Design exercise hardware for human space flight.	Biomedical Engineering
Richard Rainbolt	Allen, TX	Support the development of software and hardware for a computer networking system in the NASA/JSC Biotechnology Facility.	Software Development
Regina North	Houston, TX	Work with Behavioral Laboratory on studies of groups in isolated environments.	Multicultural Factors
Jon Ward	Dallas, TX	Provide software engineering consultation on development of a computer networking system for the NASA/JSC Biotechnology Facility and development of the Gas Locker.	Software Development
Richard Young, Ph.D.	Kennedy Space Center, FL	Support NASA Exobiology and CELSS programs through interaction with NASA Headquarters, field centers, national and international advisory committees, and the scientific community.	Exobiology/CELSS

APPENDIX III

HONORARIA RECIPIENTS 1995

**HONORARIA RECIPIENTS
1995**

Name	Address	Description of Work
Clarence Alfrey	Gulf Coast Regional Blood Center Houston, TX	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Phillippe Arbeille	Med Nucl - Ultrasons Tours, France	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Gideon Ariel	Trabuco Canyon, CA	To participate in the Exercise Countermeasures Discipline Working Group meeting in Houston, TX August 17-18, 1995.
Robert Arnold	University of Pittsburgh Pittsburgh, PA	To serve as a member of the Bioethics Policy Task Force reviewing issues related to research involving human subjects.
Kenneth M. Baldwin	California College of Medicine Irvine, CA	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Peter Bennett	Duke University Medical Center Durham, NC	To participate in the Human Research Facility Science Working Group meetings in Houston, TX on January 17-19, 1995 and on May 15-16, 1995.
Phillip Bishop	University of Alabama Tuscaloosa, AL	To serve as chairman of the Exercise Countermeasures Discipline Working Group meeting in Houston, TX on August 17-18, 1995 and to prepare a report for the Group.
F. Owen Black	Portland, OR	To participate in the Human Research Facility Science Working Group meetings in Houston, TX on January 17-19, 1995 and on May 15-16, 1995.
Joey Boyce	Sandia National Laboratories Albuquerque, NM	To participate in the Human Research Facility Science Working Group meeting in Houston, TX on January 17-19, 1995.
William Briggs	Hutchinson, KS	To participate in the STEP training workshop July 16 - August 5, 1995.
Jim A. Bryant	Plattsmouth, NE	To participate in the STEP training workshop July 16 - August 5, 1995.
Bruce Butler	University of Texas Medical School Houston, TX	To serve on the Advisory Committee for the Insuit Doppler Project.
Peter Cavanagh	Penn State University University Park, PA	To participate in the Human Research Facility Science Working Group meetings in Houston, TX on January 17-19, 1995 and on May 15-16, 1995.
Wenyaw Chen	UT-Houston School of Public Health Houston, TX	To analyze data to determine the effects of space flight on the circadian rhythms of astronauts.
Priscilla Clarkson	University of Massachusetts Amherst, MA	To participate in the Human Research Facility Science Working Group meeting in Houston, TX on May 15-16, 1995.
Priscilla Clarkson	University of Massachusetts Amherst, MA	To participate in the Exercise Countermeasures Discipline Working Group meeting in Houston, TX August 17-18, 1995.
Stephen Coburn	Fort Wayne State Development Center Ft. Wayne, IN	To participate in the Nutritional Requirements for Extended Duration Space Flight Workshop in Houston, TX March 27-28, 1995.

HONORARIA RECIPIENTS 1995		
Name	Address	Description of Work
Ruthanne Cook	Cold Springs, CO	To participate in the STEP training workshop July 16 - August 5, 1995.
Tony L. Dearman	Tahlequah, OK	To participate in the STEP training workshop July 16 - August 5, 1995.
David Dinges	University of Pennsylvania Philadelphia, PA	To participate in the Human Research Facility Science Working Group meeting in Houston, TX January 17-19, 1995.
V. Reggie Edgerton	UCLA Los Angeles, CA	To participate in the Human Research Facility Science Working Group meeting in Houston, TX on January 17-19, 1995.
William L. Evans	Penn State University University Park, PA	To participate in the Human Research Facility Science Working Group meetings in Houston, TX on January 17-19, 1995 and on May 15-16, 1995.
F. Andrew Gaffney	Vanderbilt University Nashville, TN	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Rupert Gerzer	DLR Institute of Aerospace Medicine Koln, Germany	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Claude Gharib	Faculte de Medecine Lyon Grange- Blanche Lyon, France	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Harold Guy	University of California San Diego La Jolla, CA	To chair and to participate in the Human Research Facility Science Working Group meetings in Houston, TX on January 17-19, 1995 and on May 15-16, 1995.
Francis Haddy	USUHS Bethesda, MD	To participate in the Human Research Facility Science Working Group meeting in Houston, TX on January 17-19, 1995 and on May 15-16, 1995.
Francis Haddy	USUHS Bethesda, MD	To participate in the Exercise Countermeasures Discipline Working Group meeting in Houston, TX August 17-18, 1995.
Tim C. Harris	Hutchinson, KS	To participate in the STEP training workshop July 16 - August 5, 1995.
Ceile E. Hedberg	R. W. Johnson Pharmaceutical Research Institute Raritan, NJ	To participate in the Animal Care and Use Ad Hoc Review Committee at Kennedy Space Center July 17, 1995.
Atsusi Hirumi	University of Houston Clear Lake Houston, TX	For pre-planning, preparation, and presentation of a seminar "Training on the Internet" on July 18, 1995 for teachers participating in the STEP workshop.
Harry Hogan	Texas A&M University	To participate in the Exercise Countermeasures Discipline Working Group meeting in Houston, TX August 17-18, 1995.
Michael Holick	Boston University School of Medicine Boston, MA	To participate in the Nutritional Requirements for Extended Duration Space Flight Workshop in Houston, TX March 27-28, 1995.
David Huston	Baylor College of Medicine Houston, TX	To participate in the Human Research Facility Science Working Group meetings in Houston, TX on January 17-19, 1995 and on May 15-16, 1995.
John M. Johnson	University of Texas Health Science	To participate in the International Workshop

HONORARIA RECIPIENTS 1995		
Name	Address Center San Antonio, TX	Description of Work on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
David R. Jones	Aeropsych Associates San Antonio, TX	To serve as a member of the Bioethics Policy Task Force reviewing issues related to research involving human subjects.
Robert Kane	VA Medical Center Baltimore, MD	To participate in the Human Research Facility Science Working Group meeting in Houston, TX on May 15-16, 1995.
J. Lawrence Katz	Case Western Reserve University Cleveland, OH	To participate in the Exercise Countermeasures Discipline Working Group meeting in Houston, TX August 17-18, 1995.
Carl Keen	University of California Davis Davis, CA	To participate in the Nutritional Requirements for Extended Duration Space Flight Workshop in Houston, TX March 27-28, 1995.
Wilbert J. Keon	University of Ottawa Heart Institute Ottawa, Canada	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
John A. Krasney	SUNY-Buffalo Buffalo, NY	To participate in the Human Research Facility Science Working Group meeting in Houston, TX on January 17-19, 1995.
Bob A. Lacey	Hutchinson, KS	To participate in the STEP training workshop July 16 - August 5, 1995.
Christian J. Lambertsen	Institute for Environmental Medicine Philadelphia, PA	To serve on the Advisory Committee for the Insuit Doppler Project.
Nancy Lane	University of California San Francisco San Francisco, CA	To participate in the Human Research Facility Science Working Group meetings in Houston, TX on January 17-19, 1995 and May 15-16, 1995.
Benjamin Levine	Institute of Exercise and Environmental Medicine Dallas, TX	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Dag Linnarsson	Karolinska Institutet Stockholm, Sweden	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Curtis A. Lubbers	Omaha, NE	To participate in the STEP training workshop July 16 - August 5, 1995.
Mark E. Madsen	Cortez, CO	To participate in the STEP training workshop July 16 - August 5, 1995.
Tadaki Mano	Nagoya University Nagoya, Japan	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Walter B. Mertz III	Omaha, NE	To participate in the STEP training workshop July 16 - August 5, 1995.
Jere Mitchell	University of Texas Southwestern Medical Center Dallas, TX	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
George B. Morton	Tahlequah, OK	To participate in the STEP training workshop July 16 - August 5, 1995.
Sharon Mulvagh	Mayo Clinic Rochester, MN	To participate in the Human Research Facility Science Working Group meeting in Houston, TX on January 17-19, 1995.
Donald McCormick	Emory University School of Medicine	To participate in the Nutritional Requirements for Extended Duration Space Flight

HONORARIA RECIPIENTS 1995		
Name	Address Atlanta, GA	Description of Work Workshop in Houston, TX March 27-28, 1995.
Anita McDonald	Farmington, NM	To participate in the STEP training workshop July 16 - August 5, 1995.
Greg Nelson	Jet Propulsion Lab	To participate in the Human Research Facility Radiation Discipline Group meeting in Houston, TX July 27-28, 1995.
Robyn Nishimi	Office of Technology Assessment U. S. Congress Washington, D.C.	To serve as a member of the Bioethics Policy Task Force reviewing issues related to research involving human subjects.
Anthony Norman	University of California-Riverside	To participate in the Nutritional Requirements for Extended Duration Space Flight Workshop in Houston, TX March 27-28, 1995.
Peter Norsk	Rigshospitalet 7522 Copenhagen, Denmark	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Charles Oman	MIT Cambridge, MA	To participate in the Human Research Facility Science Working Group meetings in Houston, TX on January 17-19, 1995 and on May 15-16, 1995.
Heinz Oser	European Space Agency Paris, France	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Chester Pierce	Harvard University Cambridge, MA	To serve as a member of the Bioethics Policy Task Force reviewing issues related to research involving human subjects.
Ray Pinto	Wingate, NM	To participate in the STEP training workshop July 16 - August 5, 1995.
James T. Raines	Omaha, NE	To participate in the STEP training workshop July 16 - August 5, 1995.
Ledeon A. Rickey	Colorado Springs, CO	To participate in the STEP training workshop July 16 - August 5, 1995.
David Robertson	Vanderbilt University Nashville, TN	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Steven R. Rust	Shiprock, NM	To participate in the STEP training workshop July 16 - August 5, 1995.
Wilhelm Rutishauser	University Hospital Geneva, Switzerland	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Lex Schultheis	Johns Hopkins Hospital Baltimore, MD	To participate in the Human Research Facility Science Working Group meeting in Houston, TX on January 17-19, 1995.
Mark C. Shults	Madison, WI	To present a seminar "Glucose Sensors" at the NASA/Johnson Space Center and to discuss possibilities for the development of a glucose sensor compatible with the space bioreactor.
James Slater	Loma Linda University Medical Center Loma Linda, CA	To participate in the Human Research Facility Radiation Discipline Group meeting in Houston, TX July 27-28, 1995.
Mark Sothmann	Indiana University Medical School Indianapolis, IN	To participate in the Human Research Facility Radiation Discipline Group meeting in Houston, TX July 27-28, 1995.
Sandra K. Spahr	Manitou Springs, CO	To participate in the STEP training workshop

HONORARIA RECIPIENTS 1995		
Name	Address	Description of Work July 16 - August 5, 1995.
J. Stegemann	Deutsche Sporthochschule Koln Koln, Germany	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Kenji Sunagawa	National Cardiovascular Center Research Institute Osaka, Japan	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Billy F. Taylor	Salina, KS	To participate in the STEP training workshop July 16 - August 5, 1995.
Charles M. Tipton	University of Arizona Tucson, AZ	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Paul W. Todd	University of Colorado Boulder, CO	To participate in the Human Research Facility Radiation Discipline Group meeting in Houston, TX July 27-28, 1995.
John V. Tyberg	University of Calgary Health Science Centre Calgary, Canada	To participate in the International Workshop on Cardiovascular Research in Space in Dallas, TX September 12-14, 1995.
Arthur C. Vailas	University of Houston Houston, TX	To participate in the Exercise Countermeasures Discipline Working Group meeting in Houston, TX August 17-18, 1995.
James Wall	Christian Century Magazine Chicago, IL	To serve as a member of the Bioethics Policy Task Force reviewing issues related to research involving human subjects.
Ranganath A. Weiner	Florissant, CO	To participate in the STEP training workshop July 16 - August 5, 1995.
Kristey S. Williams	Hutchinson, KS	To participate in the STEP training workshop July 16 - August 5, 1995.
Nancy A. Willis	Tahlequah, OK	To participate in the STEP training workshop July 16 - August 5, 1995.
Jack Wilmore	University of Texas at Austin Austin, TX	To participate in the Exercise Countermeasures Discipline Working Group meeting in Houston, TX August 17-18, 1995.
Lynne Zielinski	Long Grove, IL	To pre-plan, prepare, and present on July 24-August 2, 1995 to the teachers participating in the STEP program July 16-August 5, 1995.

APPENDIX IV

SUBCONTRACTS

SUBCONTRACTS 1990 - 1995			
Principal Investigator	Contracting Organization	Description of Work	Discipline Area
	American College of Sports Medicine Indianapolis, IN	Study effects of exercise on human physiological systems with special applications to adaptation to microgravity environments.	Exercise Physiology
David Anderson, Ph.D.	U. of Michigan, Ann Arbor, MI	Investigate the effect of microgravity on the vestibulo-ocular reflex and other classes of eye movement (project included in the NASA Microgravity Vestibular Investigation).	Neurophysiology
Phillip Bishop, Ed.D.	University of Alabama Tuscaloosa, AL	Design research projects, direct data collection, data evaluation, and presentation of final reports.	Exercise Physiology
Alain Berthoz, Ph.D.	College de France Paris, France	Support Microgravity Vestibular (MVI) Investigations and complete publications from STS-42 Flight in 1992 (IML-1) on MVI's objective #6: Visual Vestibular Interaction.	Neurophysiology
F. Owen Black, M.D.	Good Samaritan Hospital Portland, OR	Investigate effects of microgravity on maintenance of posture and generation of positional nystagmus (project included in the NASA Microgravity Vestibular Investigations Mission Series).	Neurophysiology
David Cardus, Ph.D.	Baylor College of Medicine, Houston, TX	Develop and evaluate a rotating artificial gravity simulator as a tool for investigating cardiovascular changes in response to varying forces.	Cardiovascular Physiology
Bernard Cohen, M.D.	Mount Sinai Medical Center New York, NY	Construct and test optokinetic apparatus for use in ground-based research on the effects of gravity on optokinetic nystagmus.	Neurophysiology
Gilles Clement, Ph.D.	MEDES Paris, France	Investigate eye movements of the astronauts during various phases of shuttle missions during voluntary movements of the eye and head.	Neurophysiology
J. Conroy	Creative Solutions Intn'l, Inc. Annandale, VA	Test usability of Life Sciences Data Archive and develop experience-based user-oriented changes.	Human Factors Engineering Software Testing
Ron Croston, Ph.D.	Ron Croston, Ph.D. and Assoc. Inc. Houston, TX	Develop Payloads Integration Planning System (PIPS) and modules of program integration and project management concepts.	Payload Data Management
Paul Dizio, Ph.D. James Lackner, Ph.D.	Brandeis University Waltham, MA	Analyze data acquired in the MVI experiment performed on IML-1 specifically to analyze the pre- and post-flight data for the pitch runs of FO-1.	Neurophysiology
F. Dutcher	George Washington University Washington, DC	Develop experiment summary database for NASA Life Sciences Flight Research.	Library Sciences
Larry Fogg, Ph.D.	Rush Presbyterian Hospital Chicago, IL	Predict astronaut performance based on battery of personality and cognitive tests and devise statistical functions to interpret results.	Psychology and Behavior and Biostatistics
Fred Guedry, Ph.D.	University of W. Florida Pensacola, FL	Investigate problems in dynamic postural control after short orbital missions. Participate in analysis of data from NASA Microgravity Vestibular Investigation.	Neurophysiology

SUBCONTRACTS 1990 - 1995			
Principal Investigator	Contracting Organization	Description of Work	Discipline Area
J. Hooker, Ph.D.	Houston Baptist University Houston, TX	Investigate and evaluate applicability of nonlinear chaos measures to cardiovascular system dynamics in normal and microgravity environments.	Cardiovascular Physiology
John Hoyer, M.D.	Children's Hospital Philadelphia, PA	Investigate urinary proteins as possible inhibitors to renal stone formation during space flight	Regulatory Physiology
Makoto Igarashi, M.D.	Nihon University Tokyo, Japan	Provide scientific support for NASA Microgravity Vestibular Investigation: Vestibulo-ocular reflex suppression, optokinetic after-nystagmus, and visual-vestibular interaction.	Neurophysiology
Edward Jarmul, Ph.D.	University of West Florida Pensacola, FL	Research potential methods of decreasing the incidence of spatial disorientation (SD) accidents in the aerospace community through the use of a man-machine interface, e.g. , vibro tactile stimulation.	Neurophysiology
Ralph Jell, Ph.D.	University of Manitoba Winnipeg, Canada	Study the relationship between visually driven eye movements and stimulation of the gravity-sensitive organs.	Neurophysiology
David Jones, M.D.	Aeropsych Associates San Antonio, TX	Provide psychiatric evaluation of astronaut candidates.	Psychiatry and Behavior
C. G. Kevorkian, M.D.	Baylor College of Medicine Houston, TX	Provide medical internships in neuromuscular research and muscular atrophy.	Neuromuscular Physiology
S. Kleis, Ph.D.	University of Houston Houston, TX	Model the fluid flow field in a rotating wall perfused vessel on STS-70 using cell growth and fluid dynamics verification experiments.	Microgravity Fluid Dynamics
James Lackner, Ph.D.	Brandeis University Waltham, MA	Provide scientific support for NASA Microgravity Vestibular Investigation: Vestibulo-ocular reflex suppression, optokinetic after-nystagmus, and visual-vestibular interaction.	Neurophysiology
Christian Lambertsen, M.D.	University of Pennsylvania Philadelphia, PA	Establish diving procedures for a neutral buoyancy laboratory.	Hyperbaric Medicine
D. Maxwell	Biological Sciences Curriculum Studies Colorado Springs, CO	Develop a curriculum for the Summer Teacher Enhancement Program (STEP) to train middle school teachers, focusing on the history and nature of science and technology as related to the International Space Station	History and nature of science and technology in education
Michael McEwen	Spaceflight Integ. and Operations Houston, TX	Define and plan implementation of operations and data requirements for life sciences space flight experiments, develop requirements for space craft onboard data handling and ground operations and data handling facility capabilities.	Spaceflight and Ground Data Management
Chuck Oman, Ph.D.	MIT Cambridge, MA	Investigate vestibulo-ocular reflex function in microgravity and motion sickness (project included in the NASA Microgravity Vestibular Investigation).	Neurophysiology
Donald Parker, Ph.D.	Miami University Oxford, OH	Investigate sensory perception reporting (project included in the NASA Microgravity Vestibular Investigation)	Neurophysiology

SUBCONTRACTS 1990 - 1995			
Principal Investigator	Contracting Organization	Description of Work	Discipline Area
James Pawelczyk, Ph.D.	Presbyterian Hospital of Dallas, TX	Study validation and comparison of flight systems for determination of cardiac output.	Cardiovascular Physiology
Neal Pellis, Ph.D.	M.D. Anderson Cancer Center Houston, TX	Investigate the effect of microgravity on the ability of lymphocytes to locomote through the intercellular matrix.	Hematology/ Biotechnology
Ted Raphan, Ph.D.	Brooklyn College/CUNY	Support NASA's Microgravity Vestibular Investigation (MVI) in studies of optokinetic nystagmus (OKN), optokinetic after-nystagmus (OKAN) and spatial orientation in a large dome environment.	Neurophysiology
Barney Roberts	Futron Corporation Houston, TX	Process and load planning data into Program Integration Management System (PIMS) evaluating the work processes and preparing specifications for improvements.	Program Data Management
Rose Marie Robertson, M.D.	Vanderbilt Univ., Nashville, TN	Investigate the effect of fludrocortisone on the hemodynamic changes caused by bed rest.	Cardiovascular Physiology
Patricia Santy, M.D. Dean Faulk, M.D.	University of Texas Medical Branch Galveston, TX	Provide ongoing psychiatric consultation to JSC Biobehavioral Laboratory	Psychiatry and Behavior
J. Schmedtje, M.D. M. J. Davis, M.D.	University of Texas Medical Branch Galveston, TX	Provide medical monitoring of the STS-43 crew during LBNP procedure	Cardiovascular Physiology
John Schreiber, M.D., M.P.H.	Case Western Reserve University Cleveland, OH	Investigate the effects of microgravity on the host response to T-independent bacterial polysaccharides	Microbiology
John Scott	Center for Public Service Communications Arlington, VA	Develop and implement telemedicine demonstration project.	General Medicine
Mark Utell, Ph.D.	University of Rochester Med. Ctr. Rochester, NY	Conduct scientific research planning in the disciplines of toxicology, microbiology and barophysiology.	Environmental Health
Richard Vann, Ph.D.	Duke University Durham, NC	Establish diving procedures for a neutral buoyancy laboratory.	Hyperbaric Medicine
Harry Walbrecher, Ph.D.	Futron Corp. Houston, TX	Provide scientific and administrative expertise to develop and implement the Biomedical Monitoring and Countermeasures (BMAC), Project Information Management Systems (PIMS), and Life Sciences Data Archive projects.	Database Management
Lynne Witham	Clarke Consulting Group	Provide cross-cultural training to NASA's Medical Sciences Division on how to work and negotiate with Russians.	Behavioral Training

APPENDIX V

SEMINARS (1990 -PRESENT)

Hypobaric and Hyperbaric Decompression Sickness
December 28, 1990

Regulation of Muscle Growth: Role of Myogenic Determination Factors and Insulin-Like
Growth Factors
April 25, 1991

USSR Delegation Presents Spaceflight Data from Mir
May 14, 1991

Studies of the Causes and Prevention of Orthostasis Induced by the Hypogravic state
June 12, 1991

Theoretic Effects of Barometric Pressure and Oxygen on Cranial Fluid Shifts
June 27, 1991

The Role of Angiotensin II and Other Peptides in the Regulation of Salt Intake
August 1, 1991

Potential Aerospace Applications for Doppler Ultrasound Monitoring
August 28, 1991

Cohabiting Insulin Receptors and G-Proteins: Incest or Adultery?
December 5, 1991

Gravity, Hypoxia, and Pulmonary Circulation
January 8, 1992

Patterns in Sleep Biosignals May Quantify Space Motion Sickness and Other Microgravity
Effects on Astronauts
October 22, 1992

Effective Gravitational Acceleration on Ventricular Filling: Diastolic Ventricular Function in
Microgravity and 1G
November 13, 1992

Gravitational Stress and Fluid Volume Regulation in Humans
November 20, 1992

Physiological Consequences of Unloading Human Skeletal Muscle
Gary Dudley, Ph.D., April 5, 1993

Investigation of Vestibular Mechanics in Aerospace Environments Using Computational Techniques

Braden McGrath, April 23, 1993

The Dynamics of the G-Excess Illusion

Cdr. Angus Rupert, M.D., Ph.D., April 23, 1993

Life Sciences Research thrusts: A Perspective from NASA Headquarters

Space Medicine Grand Rounds

Harry Holloway, Ph.D., August 26, 1993

Experiments with the Artificial Gravity Simulator (AGS)

David Cardus, M.D., August 27, 1993

Cognitive Psychophysiology: The State of the Art

Ernest S. Barratt, Ph.D., August 27, 1993

The Evolution of Physical-Chemical Life Support Systems from Voskhod through Mir and Space Station Freedom

Space Medicine Grand Rounds

William J. Crump, M.D., September 29, 1993

Recent Progress in Liver Disease: Diagnosis and Therapy

Natalie Murray, M.D., October 4, 1993

Chernobyl Disaster Experiences as a Prototype for Conducting Future Large-Scale Disaster Research

Distinguished Lecturer Series

Victor Koscheyev, M.D., Ph.D., November 18, 1993

New Approaches for Controlling Level of Heat Exchange in Extreme Environments through Measuring Finger Temperature in Protective Equipment

Victor Koscheyev, M.D., Ph.D., November 18, 1993

Reproductive Considerations for Space Flight

Space Medicine Grand Rounds

Richard T. Jennings, M.D., December 7, 1993

Vestibular Adaptation to Altered Gravito-Inertial Environments

Space Medicine Grand Rounds

Adrian Perachio, Ph.D., January 12, 1994

An Examination of the Role of Biophysical Phenomena in Cardiovascular Response to Weightlessness: An Update on the "Hearts in Space" KC-135 Parabolic Flight Experiments

George Pantalos, Ph.D. and Keith Sharp, Ph.D., January 28, 1994

Adaptation to Intermittent Hypoxia: Protective Cross Effects
Felix Z. Meerson, M.D., February 3, 1994

Adaptation to Repeated Stress: Protective Cross Effects
Felix Z. Meerson, M.D., February 4, 1994

The Mapping of Mars
Space Medicine Grand Rounds
Hans Mark, Ph.D., February 16, 1994

Effect of Radiation on Long-Duration Human Space Exploration
Space Medicine Grand Rounds
Michael Stanford, Ph.D., March 23, 1994

Sleep Deprivation, Vigilance Deficits, and the Brain: Relevance for Long-Term Exposure to
Microgravity
Ralph Lydic, Ph.D., March 28, 1994

Development of Exercise Countermeasures for Space Flight
Space Medicine Grand Rounds
Suzanne Fortney, Ph.D., April 19, 1994

Modeling and Simulation of Human Bone Structures
Catherine G. Ambrose, Ph.D. and Timothy P. Harrigan, Ph.D., April 29, 1994

Wintering Over in the Antarctic: A Physician's Experience
Space Medicine Grand Rounds
Matt Houseal, M.D., May 25, 1994

Star Trek: All the Right Stuff
Space Medicine Grand Rounds
Majel Barrett Roddenberry, July 13, 1994

Updates in Space Medicine
Space Medicine Grand Rounds
Arnauld E. Nicogossian, M.D., July 21, 1994

Role of Exercise in the Prevention and Reversal of Disuse Osteopenia
Sue Bloomfield, Ph.D., August 15, 1994

Models of Decompression Sickness
Space Medicine Grand Rounds
Michael L. Gernhardt, Ph.D., September 29, 1994

NASA Cardiovascular Research
Space Medicine Grand Rounds
Claire M. Lathers, Ph.D., December 13, 1994

Consequences of Renal Stone Formation
John Hoyer, M.D., January 19, 1995

Biological Rhythms in Space Medicine
Space Medicine Grand Rounds
Michael Smolensky, Ph.D., January 24, 1995

Radiation Risk Estimation Based on Biological Quantal Effects
Dean C. Kaul, January 25, 1995

A Brief Overview of Japanese A-Bomb Survivor Dosimetry, DS86,
Dean C. Kaul, January 25, 1995

Immersed False Vertical Room: A New Terrestrial Model of Microgravity's Neurosensory
Effects
Alfred C. Coats, M.D., February 22, 1995

The International Mars Mission:
A Report from the 1991 International Space University Design Project
Space Medicine Grand Rounds
Patrick J. McGinnis, M.D., February 28, 1995

Surgical Techniques in Microgravity
Space Medicine Grand Rounds
Mark R. Campbell, M.D., April 25, 1995

Entering Space and Returning to Earth: Cardiovascular Consequences
Space Medicine Grand Rounds
Jay Buckey, M.D., May 16, 1995

Building Object-Oriented Laboratory Data Acquisition Systems
Rex Gantenbein, Ph.D., May 19, 1995

Cell Structure and Function: Effects of Low Gravity and Hyperbaric Oxygenation
Space Medicine Grand Rounds
Edward Piepmeier, Jr., Ph.D., Ph.D., June 6, 1995

Telecommunications Applications:
The Impending Revolution in Health Care
Space Medicine Grand Rounds
Earl W. Ferguson, M.D., Ph.D., July 18, 1995

The Isolated, Confined Environment of Biosphere 2
Space Medicine Grand Rounds
Taber MacCallum and Jane Poynter, August 24, 1995

Hollow Fiber and Flat Stock Cell Culture Units:
Advantages and Disadvantages for Flight Experiment
Elena Milkova, Ph.D., September 8, 1995

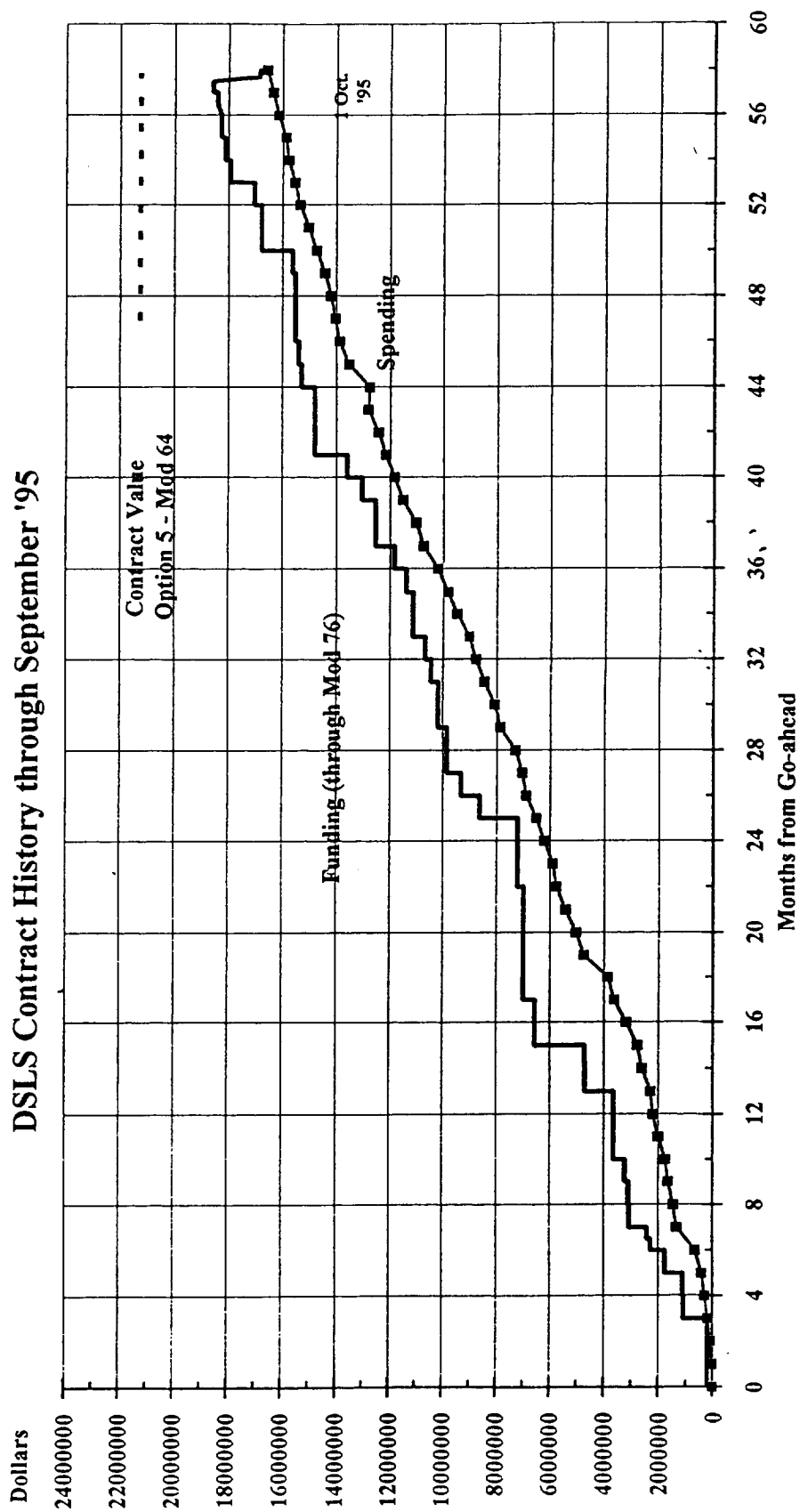
The Effects of Betaxolol Ophthalmic Solution on Intraocular Pressures
During Parabolic Flight
Space Medicine Grand Rounds
Terrence Pattinson, M.D., September 26, 1995

Space Motion Sickness: Problem Solved?
Space Medicine Grand Rounds
Thomas Marshburn, M.D., September 26, 1995

APPENDIX VI

FIGURE I

FIGURE I

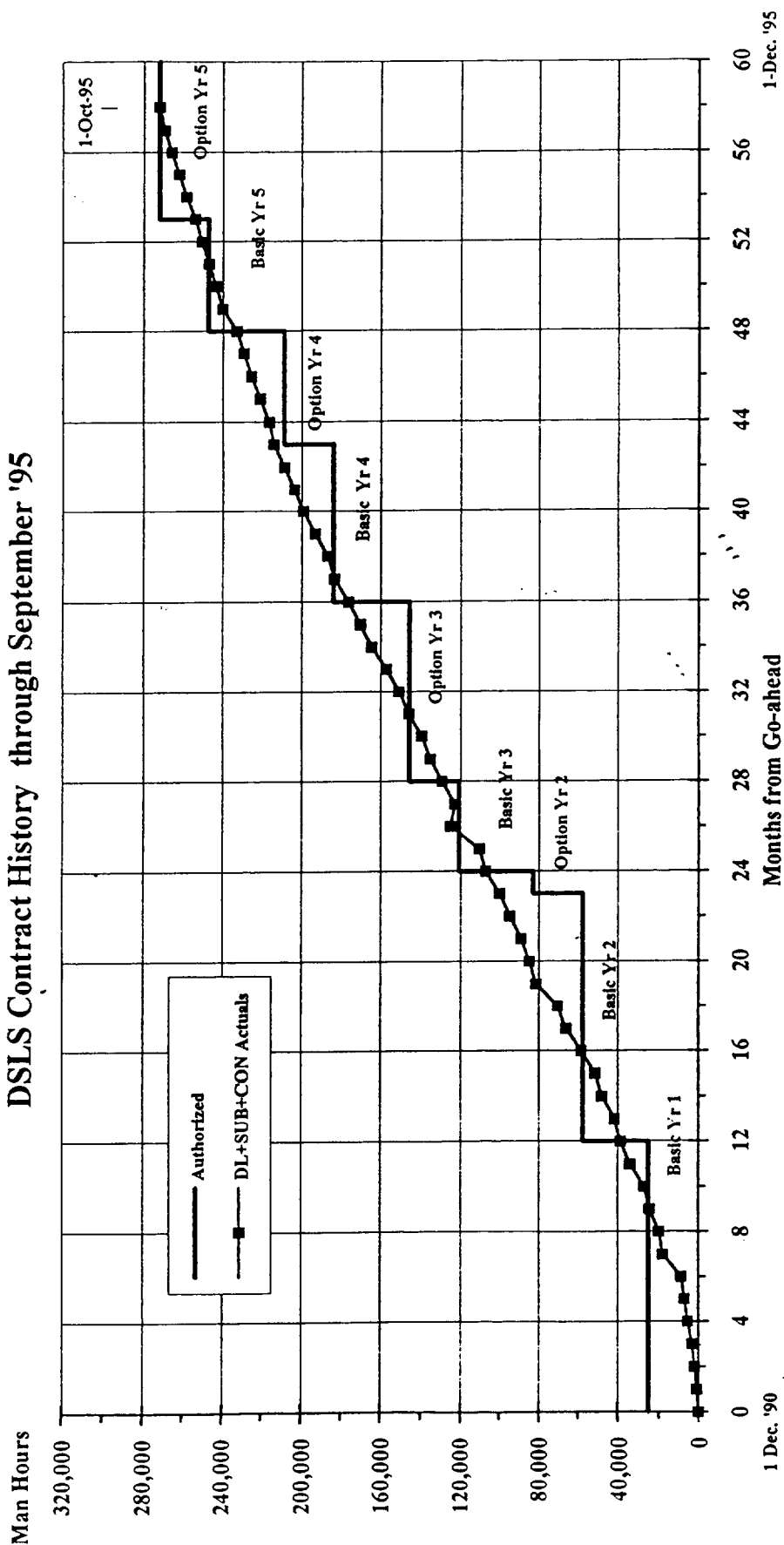


APPENDIX VII

FIGURE II

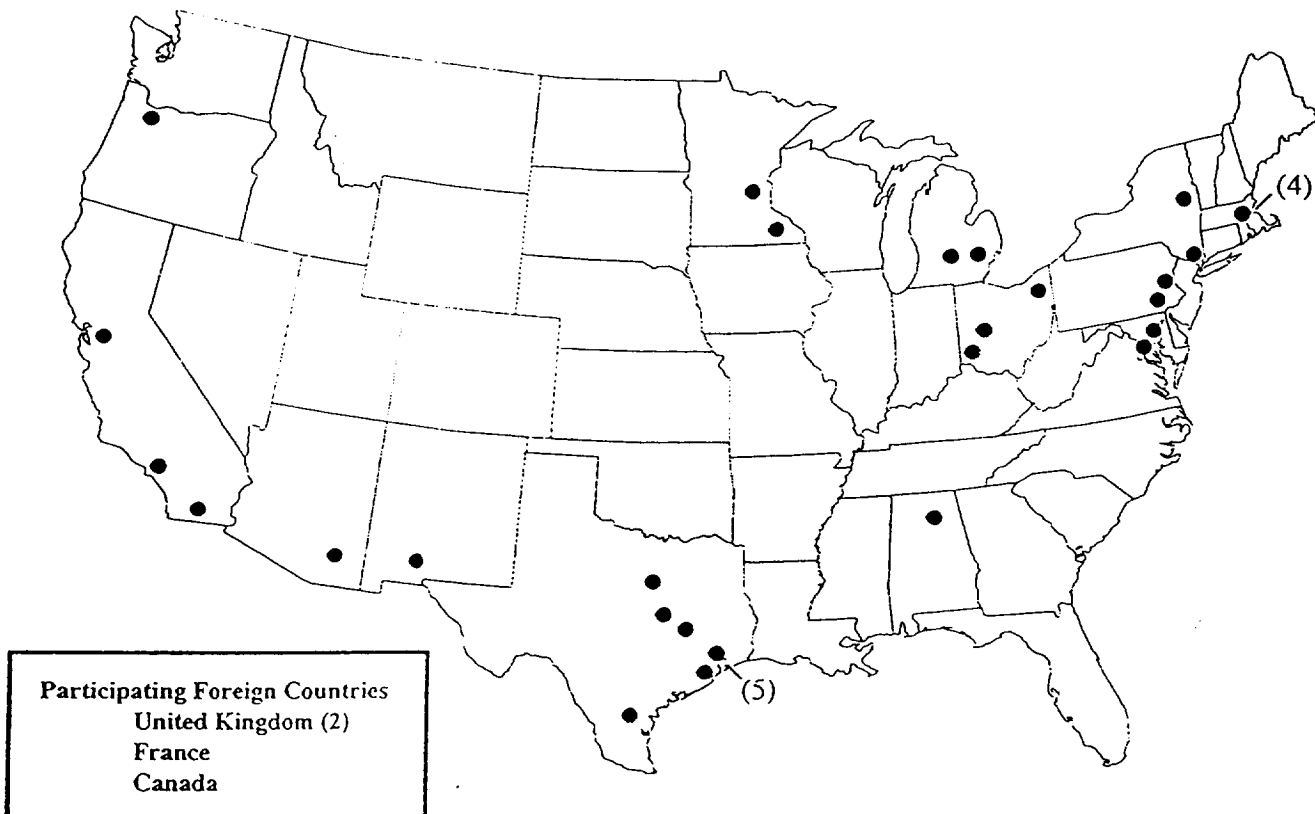
FIGURE II

DSLS Contract History through September '95



APPENDIX VIII
SPACE LIFE SCIENCES CONSORTIUM

SPACE LIFE SCIENCES CONSORTIUM



University of Arizona
 Baylor College of Medicine
 Boston University School of Medicine
 Brandeis University
 University of California, Los Angeles
 University of California, San Diego
 Case Western Reserve University
 Centre National de la Recherche Scientifique (France)
 Good Samaritan Hospital & Medical Center
 University of Alabama in Huntsville
 Harvard/MIT Joint Health Sciences Program
 University of Houston, Downtown
 University of Houston, Clear Lake
 Lehigh University
 Los Alamos National Laboratory
 Massachusetts Institute of Technology
 McGill University (Canada)
 Miami University
 Mayo Clinic
 University of Michigan
 Michigan State University

University of Minnesota
 Mt. Sinai Medical Center
 National Institutes of Health
 • National Institute on Deafness & Other Communication Disorders
 • National Institute of Neurological Disorders and Stroke
 • Office of Science Policy and Legislation
 Pennsylvania State University
 RAF Institute of Aviation Medicine (U.K.)
 Rensselaer Polytechnic Institute
 Rice University
 University of Sheffield
 Stanford University
 Texas A&M University System
 Uniformed Services University of the Health Sciences
 University of Texas, Austin
 University of Texas Health Science Center at Houston
 University of Texas Health Science Center at San Antonio
 University of Texas Medical Branch at Galveston
 University of Texas Southwestern Medical Center at Dallas
 Wright State University

